

Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

In the Matter of)	
)	
Reassessment of Federal Communications)	ET Docket No. 13-84
Commission Radiofrequency Exposure)	
Limits and Policies)	
)	
Proposed Changes in the Commission’s Rules)	ET Docket No. 03-137
Regarding Human Exposure to Radiofrequency)	
Electromagnetic Fields)	

REPLY COMMENTS OF PONG RESEARCH CORPORATION

Pong Research Corporation (“Pong”) submits these reply comments in response to the Federal Communications Commission’s (“FCC”) First Report And Order, Further Notice of Proposed Rule Making, and Notice Of Inquiry (“NOI”) in the above-captioned dockets. Most of Pong’s reply comments relate to the NOI portions of these proceedings.

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In its initial comments in response to the NOI¹, Pong (and other commenters) advanced several basic premises: *viz.* that (1) current FCC guidelines for Specific Absorption Rates (“SAR”)² particularly underestimate children’s exposure to RF energy and, so, should be modified sufficiently to protect them; (2) FCC testing protocols likewise understate consumers’ exposure to RF energy generally due to proximity allowances that fail to reflect normal use, and should be changed accordingly; (3) device certification processes should account for accessories, specifically cases, that have become common today, inasmuch as extant antiquated standards from 1997 already address less prevalent accessories like belt clips and holsters; (4) consumers should receive more accessible and complete information regarding RF exposure, including at point of sale; and (5) the FCC should encourage consumer awareness of RF exposure risks and related precautionary measures, and not relax existing safety standards.

Several commenters in these proceedings, however, have mischaracterized the current state of science with respect to human RF energy exposure, in an effort to undermine these themes—based in part upon the fatally flawed notion that existing RF safety standards incorporate a “50-fold” safety factor. In these commenters’ views, *it does not matter that* (1) children’s exposure to RF energy exceeds that of adults, *or that* (2) consumers normally use portable devices proximate to, or even at “zero distance” from, their bodies, *or that* (3) device certification processes fail to account for cases that, concededly, may increase SAR (not to mention decrease performance), *or that* (4)

¹ Filing of Pong Research Corporation in Docket 13-84 dated September 3, 2013, <http://apps.fcc.gov/ecfs/document/view?id=7520940737> (“Pong Comments”).

² See *In re Guidelines for Evaluating the Environmental Effects of Radiofrequency Radiation*, Release No. 96-326, 11 F.C.C.R. 15123, 15124 (1996). The FCC therein adopted the current radio-frequency (“RF”) radiation exposure standards that establish a maximum SAR of 1.6 watts per kilogram (1.6 W/kg) for spatial peak SAR averaged over any 1 gram of tissue. See 47 C.F.R. §2.1093(d)(2). All portable devices distributed or sold in the United States must comply with this limit.

consumers may be unaware of RF exposure risks and precautionary measures, *or that* (5) existing RF safety standards might be relaxed, on the basis of flawed scientific assumptions, among them that the putative margin of error is 50 times a level of any “real” risk.

I. SOME COMMENTERS MISCHARACTERIZE THE STATE OF SCIENCE TODAY WITH RESPECT TO RF EXPOSURE FROM WIRELESS DEVICES.

A. Background: The Government Accountability Office (“GAO”) Report

Some commenters have tacitly suggested—based on 20-year-old observations, and mischaracterizing the state of science today—that cell phones are safe to a scientific certainty. These parties hope that the FCC will so conclude for them (as they refuse to state it themselves), determine that changes to the testing guidelines are unnecessary (even to improve accuracy), decline adequately to inform consumers (so as not to “alarm” them), and close this proceeding (as essentially unnecessary). The FCC, however, should view this posture for what it is: a request that the FCC ignore its public interest obligations.

A GAO Report released August 7, 2012 (the “GAO Report”)³ urged the FCC to update its portable device radiation exposure and testing guidelines. The GAO concluded that current FCC RF exposure standards—in place since 1997 (some 4 years before the first smartphones became commercially available)—“*may not reflect the latest research,*”⁴ “*may not identify maximum exposure [to radiation] in all possible usage*

³ GAO Report, *Exposure and Testing Requirements for Mobile Phones Should Be Reassessed*, GAO-12-771, July 2012, <http://www.gao.gov/assets/600/592901.pdf>.

⁴ *Id.*, at Highlights page, emphasis added.

conditions,”⁵ and fail to test for portable device use against the body that “*could result in RF energy exposure higher than the FCC limit.*”⁶ GAO further noted, “By not formally reassessing its current limit, FCC cannot ensure it is using a limit that reflects the latest research on RF energy exposure.”⁷

GAO further noted the lack of certainty and possible risks associated with RF energy from wireless devices:

In 2001, we reported that [the United States Food and Drug Administration (“FDA”)] and others had concluded that research had not shown RF energy emissions from mobile phones to have adverse health effects, but that **insufficient information was available to conclude mobile phones posed no risk.**

Following another decade of scientific research and hundreds of studies examining health effects of RF energy exposure from mobile phone use, **FDA maintains this conclusion.** FDA stated that while the overall body of research has not demonstrated adverse health effects, **some individual studies suggest possible effects. Officials from [the National Institutes of Health (“NIH”)], experts we interviewed, and a working group commissioned by [International Agency for Research on Cancer (“IARC”)]—the World Health Organization’s agency that promotes international collaboration in cancer research—have reached similar conclusions.** For example, in May 2011 IARC classified RF energy as “possibly carcinogenic to humans.”⁸

The record in this proceeding demonstrates that the FCC’s current guidelines:

1. Do not accurately measure true radiation absorption by children, and that children absorb far greater levels of RF energy than adults;⁹

⁵ *Id.*, emphasis added.

⁶ *Id.*, emphasis added.

⁷ *Id.*

⁸ *Id.*, at pages 6-7, emphasis added.

⁹ See Section II below.

2. Allow testing at up to 25 cm distance in body-worn configuration and thus do not accurately measure true radiation absorption by users, including children so, accordingly, the proximity requirements for testing should be modified to include a “zero spacing” requirement;¹⁰

3. No longer accurately reflect how consumers actually use devices, given that—in contrast to the FCC’s 1997 guidelines that required testing of devices with belt clips and holsters in body-worn configuration—most consumers today use cases, which the record in this proceeding demonstrates can substantially increase SAR;¹¹

4. Fail to provide consumers with adequate notice of precautions they could take to minimize RF exposure; and

5. Do not adequately account for recent studies that have shown health impacts associated with RF energy, including non-thermal effects.¹²

B. The Laws of Physics and RF Exposure

These observations are grounded in part on the “inverse square law” of physics that, in the context of radiation exposure, means the intensity of RF radiation is inversely proportional to the square root of the distance from its source.¹³ Thus, for example, at a theoretical level a given constant of radiation is 6.25X as intense at 1 cm as at 2.5 cm,

¹⁰ See Section III below.

¹¹ See Section IV below.

¹² See Pong Comments, at Appendix A and footnote 81. See also Filing of Environmental Working Group (“EWG”) in Docket 13-84 dated September 2, 2013, at pages 3-9, available at: <http://apps.fcc.gov/ecfs/document/view?id=7520941812> (“EWG Comments”), and Filing of American Academy of Pediatrics (“AAP”) dated August 29, 2013 in Docket 13-84, available at: <http://apps.fcc.gov/ecfs/document/view?id=7520941318> (“AAP Comments”).

¹³ Cf. FCC Office of Engineering & Technology (“OET”), *Questions and Answers about Biological Effects and Potential Hazards of Radiofrequency Electromagnetic Fields*, OET Bulletin 56 (4th ed.), August 1999, at page 21 (noting that “[a]s with all forms of electromagnetic energy, the power density from a cellular or PCS transmitter decreases rapidly (according to an inverse square law) as one moves away from the antenna”).

and 25X as intense at 0.5 cm as at 2.5 cm.¹⁴ *At 0.25 cm, or nearer to “zero distance”—the level at which the GAO noted may more accurately reflect “normal operating positions or conditions”—the intensity is 100X that of the 2.5 cm distance at which original equipment manufacturers (“OEMs”) can test their portable devices.*¹⁵

Users may experience substantially higher SAR levels in “real world” conditions, because the cell phone radiation that consumers’ heads and bodies absorb occurs in the so-called “near field” (not just at “zero distance”) of the antenna.¹⁶ The Occupational Health and Safety Administration (“OSHA”) explained the consequent implications of the inverse square law for consumers in the context of near field RF exposures, as follows:

As you might have guessed, the reactive near-field region has another surprise in store for you. In this reactive region, not only is the [electromagnetic or “EM”] wave being radiated outward into space, but also there is a “reactive” component to the EM field. Very close to the antenna, energy of an unknown amount is held back and is stored very near the antenna surface. This reactive component can be the source of confusion and danger in attempting measurements in this region. **In other regions the power density is inversely proportional to the square of the distance from the antenna. In the vicinity very close to the antenna, the energy level can rise dramatically with only a small additional movement**

¹⁴ The formulas for this simple math follow the basic principle of the inverse square law. So (rounding certain results to 2 decimal places), $1/(.5)^2=4$; $1/(1)^2=1$; $1/(2.5)^2=0.16$; and so forth. Comparing results, 0.16 is 6.25X less than 1 and 25X less than 4. In the ultimate example of this paragraph that posits a distance of 0.25 cm, $1/(.25)^2=16$ or 100X more than 0.16 (the result at 2.5 cm).

¹⁵ While allowing up to 2.5 cm, the FCC’s OET recommends 1.5 cm separation. Cf. *Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields*, Supplement C (Edition 01-01) to Bulletin 65 (“Supplement C”), June 2001, at page 41 (explaining that “[a] separation distance of 1.5 cm between the back of a device and a flat phantom is recommended for body-worn compliance . . . [and that other] separation distances may be used, but they should not exceed 2.5 cm.”)

¹⁶ See, e.g., Supplement C, at page 9 (explaining that “[t]he user of a handset is normally in the reactive near-field region of the antenna where the electromagnetic field is mostly non-propagating . . . [and] RF energy is scattered and attenuated as it propagates through the body tissues”).

towards the antenna. This energy can be very dangerous (even hazardous) to both humans and measurement equipment where high powers are involved.

CAUTION: When the radiating dimensions of the antenna are *much smaller* than one wavelength and/or the frequency is low . . . , it is especially important to be aware of the **POTENTIALLY HAZARDOUS REACTIVE FIELDS WHICH MAY EXIST IN THE REACTIVE NEAR-FIELD**. Exercise extreme caution for both your safety and the equipment when making near-field measurements **As you move nearer to the antenna in the reactive near-field, the energy can increase much quicker than what is computed by the inverse-square law.** Some electromagnetic energy is stored in the near-field in the vicinity of the antenna that can be an unsuspected source of dangerous energy. This “reactive field” energy is especially dangerous with high power systems. The closer to the radiating source you get, the more caution should be exercised.¹⁷

In simplest terms, then, the precise amount of RF radiation exposure a consumer might experience from the near field of a cellular antenna is, for all practical purposes (to quote OSHA), “*unknown*.”¹⁸

¹⁷ Occupational Safety and Health Administration, Cincinnati Technical Center, *Electromagnetic Radiation: Field Service Memo—Electromagnetic Radiation and How it Affects your Instruments*, May 20, 1990, Section VI, emphasis added.
https://www.osha.gov/SLTC/radiofrequencyradiation/electromagnetic_fieldmemo/electromagnetic.html#section_6.

¹⁸ It is important to note that OSHA, in its 1990 statement, did not propose any particular human exposure standard—but merely described then- and still-established scientific principles concerning the behavior of “near” RF fields.

C. The “50-Fold” Safety Factor is a Myth, and in Fact Actual Exposure May be Far Higher

Against this backdrop—and in the face of the GAO Report, the NOI, and established science regarding how RF fields behave—some commenters suggest that consumers’ actual RF exposures might safely exceed the FCC’s safety standard of 1.6 W/kg SAR *by a factor of at least 50 times*, and on that basis any changes to the FCC’s testing guidelines, even if they improve accuracy, and better inform consumers, are essentially unnecessary. One commenter, for example, touts this alleged “50-fold” safety factor (relative to the FCC’s standard of 1.6 W/kg) at least 16 separate times, and takes the extraordinary view that the FCC’s standard is *not a safety matter at all*, but simply a construct for optimal portable device use and operation:

Nor does any evidence suggest that SAR values that exceed Commission limits necessarily imply unsafe operation, or that lower SAR values imply “safer” operation. In this context, CTIA agrees¹⁹ that exceeding the SAR limit “should not be viewed with significantly greater concern than compliant use,” in part due to the fifty-fold safety factor incorporated into the existing RF emission standards. **CTIA considers Supplement C’s body-worn device separation requirement an issue of proper use and operation, as opposed to one of health and safety.**²⁰

But repeatedly stating something that is false does not make it true. Further, this revisionist view notwithstanding, industry representatives will not state unqualifiedly that

¹⁹ CTIA here claims to “agree” with, and so cites ¶251 of, the NOI that (of course) took no such conclusive view. Filing of CTIA—The Wireless Association dated September 3, 2013 in Docket 13-84 (“CTIA Comments”), <http://apps.fcc.gov/ecfs/document/view?id=7520941701>, at page 56, footnote 252.

²⁰ *Id.*, at page 56, footnotes omitted. See Filing of CEA in Docket 13-84 dated September 3, 2013, at pages 11-12, <http://apps.fcc.gov/ecfs/document/view?id=7520941397> (“CEA Comments”).

“cell phones are safe.”²¹ Dane Snowden, Vice President of External and State Affairs of CTIA, for example, has testified:

I want to be very clear. **Industry has not said once, [not] once, that cell phones are safe.** The federal government, the various inter-agency working groups, have all said that it’s [sic] safe.²²

Instead commenters posit a syllogism in which **they** voice the premises that:

- Things that are unsafe evidence harm to a scientific certainty.
- Portable devices have not yet evidenced harm to a scientific certainty.

but hope that **the FCC** will state the conclusion . . .

- Therefore, portable devices are safe.

This logic is flawed.

First, “not unsafe” (the logical conclusion to this construct) does not necessarily mean “safe,” and “safe” (as defined by the FCC in this context) may lack any meaning whatsoever in light of the current proceedings. Commenters have misplaced their reliance on the FCC’s circuitous characterization that “any cell phone at or below . . . SAR levels [of 1.6 W/kg] (that is, any phone legally sold in the U.S.) is a ‘**safe**’ phone, as measured by [current testing] standards.”²³ So “safe” is detached from any notion that consumers would commonly understand, but rather merely means “at or below SAR of 1.6 W/kg as measured under 1997 FCC test protocols.” Yet the GAO Report called these

²¹ The filings by CEA, CTIA, and other industry groups are devoid of any such straightforward statement.

²² Testimony of Dane Snowden, Vice President of External and State Affairs CTIA, before City Council of Burlingame, Vermont, September 20, 2010. <http://www.youtube.com/watch?v=s5yGTZq06zQ>.

²³ <http://www.fcc.gov/encyclopedia/specific-absorption-rate-sar-cellular-telephones>, emphasis added.

very standards into doubt, which remain at issue in the NOI.

Second, commenters explain away the substantial scientific evidence of potential harm to consumers from RF radiation exposure with the notion that the “nature of scientific inquiry means that there can never be absolute proof of the negative, i.e., proof of safety; the most science can do is just to accumulate more and more data showing a lack of harm.”²⁴ But the government mandates warnings in all sorts of contexts in which products, though “not unsafe,” may pose risks to consumers.²⁵ The “industry” (to adopt one commenter’s term), however, eschews any such requirements regarding RF radiation exposure.²⁶

Third, the supposed “50-fold” safety factor inherent in RF exposure limits lacks any practical application or substantial scientific underpinning, although some commenters state this notion as an absolute.²⁷ On the one hand, this theoretical cushion depends upon notions of proximity separation that do not account for (1) “unknown” amounts of RF radiation in the near field, (2) true absorption at closer distances by virtue of the inverse square rule, or (3) how consumers actually use portable devices. One

²⁴ CTIA Comments, at page 49.

²⁵ As one example, nobody would consider automobiles “unsafe”—and, indeed, if any particular model were deemed unsafe, it could not be sold in United States commerce. Yet the Department of Transportation and other competent authorities require all sorts of devices (like seat belts, air bags, and so on) and prescribe consumer advisories—and Congress has passed federal, or otherwise enabled state, laws requiring the use of such “safety” techniques. *See also* pages 51-53, *infra*, concerning the example of how FDA regulates microwave ovens.

²⁶ *See, e.g.*, CEA Comments, at page 7 (stating that the FCC “should not require disclosure of maximum SAR information for approved devices”) and CTIA Comments, at page 42 (insisting that “a mandatory RF advisory would, at the very least, confuse consumers because the very existence of such an advisory would be perceived as a warning, *and would contradict the federal government’s message that wireless phones are safe*”) (emphasis added).

²⁷ *See, e.g.*, *Cell Phone Health Facts*, CTIA (claiming that “[t]he FCC’s safety standards include a 50-fold safety factor”) http://www.cellphonehealthfacts.com/key_things_to_know.html. CTIA’s repeated references to “safety standards” belie CTIA’s claim that the FCC’s RF exposure regulations are matters “*of proper use and operation, as opposed to one[s] of health and safety.*”

commenter's claim—that “[a]s between a zero-spacing restriction and the existing proximity restriction, . . . the latter more accurately mimics real-world SAR levels and usage,”²⁸—is manifestly erroneous, as the GAO itself has determined.²⁹ Consumers customarily carry their devices on their persons in body-worn configurations directly against their bodies, and the FCC should simply take administrative notice of this point. As if further evidence were needed on the matter, the recent proliferation of “wearable” devices—that, by definition, touch or remain at near “zero distance” to the person for extended periods of time—proves the point.³⁰

On the other hand, the calculus for the “50X” safety margin depends on a divisor of 1.6 (W/kg) and a subject “Specific Anthropomorphic Mannequin” (“SAM”) the size of a 6’2” 200-pound United States Marine.³¹ But recent research has observed biological effects from RF exposure at 0.022 W/kg—well below the current 1.6 W/kg standard.³²

²⁸ CTIA Comments, at page 57.

²⁹ GAO Report, *Highlights* section.

³⁰ Many such “wearable” devices themselves operate solely on Wi-Fi and Bluetooth connections, but nonetheless depend on smartphones—that operate on cellular signals—for essential functionality. Smartphones in these configurations will typically remain in “body-worn” configuration for prolonged time periods. Examples of such devices include so-called “smart watches” like the Samsung “Galaxy Gear.” <http://www.samsung.com/us/guide-to-galaxy-smart-devices/galaxy-gear.html>. Google Inc. has famously introduced “Google Glass”—innovative eyeglasses (available on a limited basis) that display full smartphone functionality privately to the wearer and that operate via voice commands—that now features prescription lenses, and so encourages consumers to wear them constantly. See <http://www.google.com/glass/start/>. The stated SAR for Google Glass is 1.42 W/kg. SAR Evaluation Report for Glass Model XEB, FCC ID: A4R-X1, Report #13U14955-5A, prepared for Google Inc. by ULCCS, April 15, 2013, at page 27.

³¹ Leading researcher Om P. Gandhi notes, for example, “[T]he existing cell phone certification process uses a plastic model of the head called the Specific Anthropomorphic Mannequin (SAM), representing the top 10% of U.S. military recruits in 1989 and greatly underestimating the [SAR] for typical mobile phone users, especially children” Gandhi, O.P. et al., and *Exposure Limits: The Underestimation of Absorbed Cell Phone Radiation, Especially in Children*, *Electromagnetic Biology and Medicine*, Early Online, 1-18 (2011).

³² Levitt, B.B. and Lai, H., *Biological Effects from Exposure to Electromagnetic Radiation Emitted by Cell Tower Base Stations and other Antenna Arrays*, *Environmental Reviews*, November 5, 2010, 18(NA): 369-395, 10.1139/A10-018, <http://www.nrcresearchpress.com/doi/pdf/10.1139/A10-018>. This study includes more than 100 citations, 80% of which showed biological effects at SAR levels below 1.6 W/kg. Out of the 56 papers Dr. Lai examined, 37 provided the SAR of exposure and indicated biological effects at an average 0.022 W/kg. *Id.*

As well, the SAR for a 10-year old is up to *153% higher* than the SAR for the SAM model and—when electrical properties are considered—“a child’s head’s absorption can be over two times greater, and absorption of the skull’s bone marrow can be *ten times* greater than adults.”³³ The origins of the 1.6 W/kg standard for spatial peak SAR, finally, is arbitrarily derived.³⁴

Today’s SAR standard of 1.6 W/kg derives from tests on lab rats conducted in 1980. In each study, SAR of approximately 4.0 W/kg with only 30 to 60 minutes of whole body exposure disrupted animal behavior. The American National Standards Institute (ANSI) determined that “behavioral effects, though reversible, might lead to irreversible injury during chronic exposures.”³⁵ On that basis, ANSI in 1982 discretionarily incorporated a **10-fold** margin of error (to 0.4 W/kg—averaged over 6 minutes) for whole body human exposure, equating to 8 W/kg for spatial peak SAR over any 1 gram of tissue, between 300 kHz and 100GHz in so-called “uncontrolled” environments applicable to the general population (as opposed to “controlled” workplace environments in which a higher standard might apply).³⁶ ANSI acknowledged, however, that the SAR standard omitted various factors important to assessing health risks, including “modulation frequency” and “peak intensity.”³⁷ The Institute of Electrical and Electronics Engineers (IEEE), accordingly, discretionarily (again), reduced the 8 W/kg

³³ Gandhi, O.P., emphasis added. See footnote 31, *supra*.

³⁴ *Id.*, at page 35.

³⁵ See ANSI, *Safety Levels with respect to Human Exposure to Radio Frequency Electromagnetic Fields, 300 kHz to 100 GHz*, ANSI C95-1982 (New York: The IEEE, Inc.), at page 14.

³⁶ As Gandhi notes, however: “Because the resultant Specific Absorption (SA) is identical for the general population in an uncontrolled environment, as it is for workers in a controlled environment (0.08 W/kg*30 min = 0.4 W/kg*6 min), the ‘larger safety factor’ for the general population is *non-existent*.” Gandhi, O.P., at page 3, emphasis added.

³⁷ ANSI, at page 14. A resonant frequency of 70 MHz, for instance, “results in an approximate sevenfold increase of absorption relative to that in a 2450 MHz field.” *Id.*, at page 12.

standard for peak spatial SAR by a **factor of 5** to 1.6 W/kg in 1992. The claimed “**50-fold**” safety factor that some commenters cite as a scientific absolute, owes to these arbitrary reductions. Neither IEEE nor, assuredly, ANSI is a medical, biological, or public health institution. In 1992, the wireless industry was in its infancy and, in the United States, only about 2% of the population had cell phones.³⁸ The FCC adopted the IEEE standard in 1996 although—its declarations that cell phones are “safe” notwithstanding—the FCC observed in the NOI that “[s]ince the Commission is not a health and safety agency, **we defer to other organizations and agencies with respect to interpreting the biological research necessary to determine what levels are safe.**”³⁹

The foregoing background shows that, rather than a “50-fold” safety factor, consumers’ exposure to RF radiation in the “real world” may far exceed any, even more liberal, margin of error. At proximities that reflect “normal operating positions and conditions,” the inverse square law proves that RF intensity can reach 100X that of the 2.5 cm distance at which OEMs can test their portable devices. When one accounts further for uncertainties in what OSHA calls the “reactive near-field,”⁴⁰ SAR “can increase much quicker than what is computed by the inverse-square law.”⁴¹ And, anomalies of the 6’2” 200-pound SAM model aside, real SAR for children and vulnerable populations “can be over two times greater, and absorption of the skull’s bone marrow can be ten times greater than adults.”⁴² **These combined variables indicate that, in fact, the FCC’s SAR standard for vulnerable populations may be—rather than 50**

³⁸ See, e.g., <http://www.birgit.muehlenhaus.com/education/thesis/chapter5.pdf>, at page 77 (noting that in 1991 there were 6.38 million users in the U.S.).

³⁹ NOI, Section 6, emphasis added.

⁴⁰ See OSHA, footnote 17, *supra*.

⁴¹ *Id.*

⁴² Gandhi, O.P., at page 35.

times too low—as much as 1,000 times or more too high.

Commentators nonetheless suggest that cell phones are safe to a scientific certainty, *even at levels of radiation that are up to 50 times the FCC’s current limits*. For example, CTIA states that the standards are “[b]acked by scientific evidence and set at a level 50 times below the threshold at which biological impacts are observed.”⁴³ The Telecommunications Industry Association (“TIA”) similarly claims that the “[GAO] Report that found that the FCC guideline is ‘a fiftieth’ of this SAR threshold for an adverse health effect and therefore no additional margin for precaution is needed.”⁴⁴ Of course, if one assumes, however erroneously, that cell phones are safe to a scientific certainty—even at up to 50X current FCC exposure limits—it does not matter that the testing regime might fail to simulate how consumers actually use devices under *normal operating positions or conditions*, since consumers inhabit a sort of buffer zone that extends 50X from the FCC’s exposure limits.

Though inaccurate and illogical, this line of reasoning appears to reflect some commenters’ arguments concerning proximity limits within the SAR testing program. For example, though the GAO specifically noted that the FCC’s regulations might understate true radiation absorption by users, TIA contends that “given the ample safety factor in the standard—those current procedures are sufficient for assuring consumer safety,”⁴⁵ and “there is no basis for concern about a health risk from the current allowable spacing.”⁴⁶ CTIA mirrors this view: “Adopting a ‘zero-spacing’ testing protocol is not

⁴³ CTIA Comments, at page 2.

⁴⁴ See Filing of the Telecommunications Industry Association dated September 3, 2013 in Docket 13-84 (“TIA Comments”) <http://apps.fcc.gov/ecfs/document/view?id=7520941840>, at page 19.

⁴⁵ *Id.*, at page 24.

⁴⁶ *Id.*, at page 25.

appropriate at this time. . . . In this context, CTIA agrees that exceeding the SAR limit ‘should not be viewed with significantly greater concern than compliant use,’ in part due to the fifty-fold safety factor incorporated into the existing RF emission standards.”⁴⁷

Again, *these commenters essentially hold that the FCC’s prescribed testing methods can remain inaccurate, since cell phones are safe, even at up to 50X the present limit.* This notion, followed to its logical end, leads to the implausible conclusion that *the FCC testing regime is not necessary at all.*

Of course, apart from being unhinged from the practical laws of physics (including the inverse square law and uncertainties of near-field measurements), this argument further breaks down because—in fact—cell phones have *not* been conclusively determined to be safe to a scientific certainty. In fact, a number of recent studies show health impacts from cell phone radiation. As GAO stated, “Insufficient information was available to conclude mobile phones posed no risk, [and] FDA stated that while the overall body of research has not demonstrated adverse health effects, some individual studies suggest possible effects. Officials from NIH, experts we interviewed, and a working group commissioned by IARC—the World Health Organization’s agency that promotes international collaboration in cancer research—have reached similar conclusions. For example, in May 2011 IARC classified RF energy as “possibly carcinogenic to humans.”⁴⁸

⁴⁷ CTIA Comments, at page 56.

⁴⁸ GAO Report, at pages 6-7.

D. Current Science on Biological and Health Effects of RF Exposure

Recent studies have reported adverse biological and health effects from low-level non-ionizing RF energy exposure from cell phones. For example, the 13-country “Interphone” study reported a 40% increased risk of a certain type of brain tumor called “glioma” from an average of 27 minutes of daily cell phone use over 10 years; a 2013 study involving 790,000 women in the United Kingdom found a possible increased risk of acoustic neuroma in women who had used a cell phone for more than 5 years compared to women who never used a cell phone, and the risk of acoustic neuroma increased with increasing duration of cell phone use⁴⁹; a 2011 study published in the *Journal of the American Medical Association* found that just “50-minute cell phone exposure was associated with increased brain glucose metabolism in the region closest to the antenna”⁵⁰ (a non-thermal effect); and a 2012 Yale University School of Medicine study conducted in mice concluded that exposure to radiation from cell phones during pregnancy affects the brain development of offspring, potentially leading to hyperactivity.⁵¹ Appendix A of our initial comments in this proceeding summarizes the numerous studies showing biological and health effects from cell phone radiation.⁵²

⁴⁹ Benson et al, for the Million Women Study Collaborators, 2013.

⁵⁰ Volkow, N. et al., *Effects of Cell Phone Radiofrequency Signal Exposure on Brain Glucose Metabolism*, Journal of the American Medical Association (JAMA), February 23, 2011, Vol. 305, No. 8: 808-813, available at <http://jama.jamanetwork.com/article.aspx?articleid=645813>. Cf. Lai, H. and Hardell, L., *Cell Phone Radiofrequency Radiation Exposure and Brain Glucose Metabolism*, JAMA, February 23, 2011, Vol. 305 No. 8 (commenting that in the Volkow study “brain areas that showed an increase in glucose metabolism were quite distant from the contact area [and, thus,] it is not likely that the effects observed were caused by heating.”)

⁵¹ See Pong Comments, at page 34, footnote 81.

⁵² See *Biological and Health Effects of Cell Phone Radiation/Scientific Literature and References*, Pong Comments, Appendix A. For additional studies of health impacts and cell phone radiation, see EWG Comments, at pages 7-9.

Experts from Yale University recently surveyed the latest scientific studies, as well as other data, on these topics.⁵³ The following charts correlate these studies to certain associated biological effects from RF radiation exposure.

Table 2. RF Radiation from Cell Phones and Cancer: Conclusions of Peer-Reviewed Review Studies		
AUTHOR	FINDINGS	AFFILIATION
Ahlbom A et al. (2009) ³⁴	"...the studies published to date do not demonstrate an increased risk within approximately 10 years of use for any tumor of the brain or any other head tumor.... For slow-growing tumors ...the absence of association reported thus far is less conclusive because the observation period has been too short."	International Commission for Non-Ionizing Radiation Protection
Khurana VG et al. (2009) ³⁵	"...there is adequate epidemiologic evidence to suggest a link between prolonged cell phone usage and the development of an ipsilateral brain tumor."	Australian National University
Han YY et al. (2009) ³⁶	"Some studies of longer term cell phone use have found an increased risk of ipsilateral AN [acoustic neuroma]."	Center for Environmental Oncology—University of Pittsburgh Cancer Institute
Kohli et al. (2009) ³⁷	"The evaluation of current evidence provided by various studies to suggest the possible carcinogenic potential of radiofrequency radiation is inconclusive."	Department of Internal Medicine, Government Medical College and Hospital, India
Myung et al. ³⁸	"...there is possible evidence linking mobile phone use to an increased risk of tumors from a meta-analysis of low-biased case-control studies."	National Cancer Control Research Institute, National Cancer Center, Korea
Croft et al (2009) ³⁹	"There are reports of small associations between MP-use ipsilateral to the tumour for greater than 10 years, for both acoustic neuroma and glioma, but the present paper argues that these are especially prone to confounding by recall bias."	Australian Centre for Radiofrequency Bioeffects Research
Abdus-Salam et al. (2008) ⁴⁰	"...published research works over several decades including some with over ten years of follow up have not demonstrated any significant increase in cancer among mobile phone users. However, the need for caution is emphasized as it may take up to four decades for carcinogenesis to become fully apparent."	Department of Radiotherapy, College of Medicine, University of Ibadan, Ibadan, Nigeria.
Kundi (2008) ⁴¹	"The overall evidence speaks in favor of an increased risk, but its magnitude cannot be assessed at present because of insufficient information on long-term use."	Institute of Environmental Health, Medical University of Vienna, Vienna, Austria

⁵³ See Wargo, J., Taylor, H. et al., *Cell Phones—Technology, Exposures, and Health Effects*, Environment & Human Health, Inc., 2012, available at <http://www.ehhi.org/reports/cellphones/>.

Table 4. RF Radiation from Cell Phones and Effects on Cognition, Learning, or Memory Findings

Author	Year	Species	Frequency	SAR	Exposure Duration	Effect
Narayan SN et al. ⁵²	2010	Rat	900 MHz – 1.8 GHz	NS	50 missed calls (45 sec.); within 1 hr per day for 4 weeks	Altered passive avoidance behavior and hippocampal morphology
Fragopoulou AF et al. ⁵³	2010	Mouse	900 MHz	0.41 W/kg – 0.98 W/kg	1 hr 55 min. for the first 3 days; 3 hr 45 min. on the fourth day's probe trial	Deficits in consolidation and/or retrieval of learned spatial information
Daniels WM et al. ⁵⁴	2009	Rat	840 MHz	NS	Continuous for 3 hrs/day from day 2 to day 14 after birth	Decreased locomotor activity, increased grooming and a tendency toward increased basal corticosterone levels
Nittby H et al. ⁵⁵	2008	Rat	900 MHz	0.0006 W/kg – 0.06 W/kg	2 hrs/week for 55 weeks	Reduced memory functions after GSM exposure (P = 0.02)
Eliyahu I et al. ⁵⁶	2006	Human	890.2 MHz	NS	Continuous for 2 hours	Exposure to left side of brain slowed left-hand response time
Maier R et al. ⁵⁷		Human	902 MHz	NS	Continuous for 50 min	Pulsed EMF exposure impaired cognitive performance

Table 5. Select Cell Phone Radiation Studies Demonstrating Potential Effects on Fertility

Author	Year	Effect Noted
Deluliis et al. ⁶²	2009	"RF-EMR in both the power density and frequency range of mobile phones enhances mitochondrial reactive oxygen species generation by human spermatozoa, decreasing the motility and vitality of these cells while stimulating DNA base adduct formation and, ultimately, DNA fragmentation. These findings have clear implications for the safety of extensive mobile phone use by males of reproductive age, potentially affecting both their fertility and the health and well-being of their offspring."
Salama N et al. ⁶³	2009	"Low intensity pulsed radiofrequency emitted by a conventional mobile phone kept in the standby position could affect the testicular function and structure in the adult rabbit."
Agarwal A et al. ⁶⁴	2009	"Radiofrequency electromagnetic waves emitted from cell phones may lead to oxidative stress in human semen. We speculate that keeping the cell phone in a trouser pocket in talk mode may negatively affect spermatozoa and impair male fertility."
Agarwal A et al. ⁶⁵	2008	"Use of cell phones decrease[s] the semen quality in men by decreasing the sperm count, motility, viability, and normal morphology. The decrease in sperm parameters was dependent on the duration of daily exposure to cell phones and independent of the initial semen quality."
Yan JG et al. ⁶⁶	2007	"Rats exposed to 6 hours of daily cellular phone emissions for 18 weeks exhibited a significantly higher incidence of sperm cell death than control group rats through chi-squared analysis.... [A]bnormal clumping of sperm cells was present in rats exposed to cellular phone emissions and was not present in control group rats. These results suggest that carrying cell phones near reproductive organs could negatively affect male fertility."
Wdowiak A et al. ⁶⁷	2007	"In the analysis of the effect of GSM equipment on the semen it was noted that an increase in the percentage of sperm cells of abnormal morphology is associated with the duration of exposure to the waves emitted by the GSM phone. It was also confirmed that a decrease in the percentage of sperm cells in vital progressing motility in the semen is correlated with the frequency of using mobile phones."
Panagopoulos DJ et al. ⁶⁸	2007	"Both types of radiation were found to decrease significantly and non thermally the insect's reproductive capacity, but GSM 900 MHz seems to be even more bioactive than DCS 1800 MHz. The difference seems to be dependent mostly on field intensity and less on carrier frequency."
Erogul O et al. ⁶⁹	2006	"These data suggest that EMR emitted by cellular phone influences human sperm motility. In addition to these acute adverse effects of EMR on sperm motility, long-term EMR exposure may lead to behavioral or structural changes of the male germ cell. These effects may be observed later in life, and they are to be investigated more seriously."
Aitken et al. ⁷⁰	2005	"...while RF-EMR does not have a dramatic impact on male germ cell development, a significant genotoxic effect on epididymal spermatozoa is evident and deserves further investigation."
Fejes I et al. ⁷¹	2005	"Low and high transmitter groups also differed in the proportion of rapid progressive motile sperm (48.7% vs. 40.6%). The prolonged use of cell phones may have negative effects on the sperm motility characteristics."

Table 6. Epidemiological Studies on Children and Potential Health Effects from Mobile Phone Use

Study	Date	Health Effect	Finding	Location
Hardell et al.	2008	Brain tumors	Those who used cell phones before age 20 had >5-fold increase in glioma risk.	Sweden
CEFALO Study	2004–2008	Brain tumors	“Regular users of mobile phones were not statistically significantly more likely to have been diagnosed with brain tumors compared with nonusers.”	Denmark, Norway, Sweden, and Switzerland
Danish National Birth Cohort/ UCLA	1998–2008	Behavioral	Behavior problems	Denmark
Rezk et al., Egyptian hospitals	2003–2004	Heart rate	Increased fetal and neonatal heart rate	Egypt
MOCHE	2006–2010	Environmental exposures during pregnancy and childhood	Pending	Korea
MOBI-KIDS Study	Began 2010	Brain tumors	Pending	Australia, Austria, Canada, France, Germany, Greece, Israel, Italy, New Zealand, Spain, Taiwan, and the Netherlands
MoRPheUS	2005–2010	Cognitive ability, blood pressure, or hearing	Shorter response times on learning tasks; less accurate working memory	Australia

As these summaries prove, proffers to the effect that “the consensus in the scientific community continues to be that the Commission’s standards protect human

health”⁵⁴ misrepresent the view of the scientific community with respect to the health impact of RF energy from cell phones. As the FCC itself acknowledges:

As long ago as the 1979 Inquiry we sought to gather information “in light of the increased concern about the biological effects of radio frequency radiation.” At that time, **just as is evident today, there were “considerable differences of opinion about the biological effects of low level (i.e., non-thermal or athermal) and long-term (chronic) exposure to RF radiation.”**⁵⁵

One commenter mischaracterizes the evidence of health impacts associated with RF energy, specifically with respect to non-thermal impacts, stating, “virtually all of U.S. and international health agencies and the scientific community generally, determined that the scientific literature does not support the existence of such “non-thermal effects.”⁵⁶ In support of this “present tense” proposition, the commenter cites language from an FCC proceeding concluded in 1997.⁵⁷ The commenter further states, “There is no scientific basis on which to regulate RF emissions beyond the heat-based limits that were and still are supported by the consensus of the international scientific community.”⁵⁸ But various recent studies have disproven the notion that cell phone radiation only causes thermal effects—including, among others, the Volkow study.⁵⁹ Industry commenters also mischaracterize the GAO Report. For example GAO did not find, as TIA claims, “no additional margin for precaution is needed”⁶⁰ and GAO did not conclude, as CTIA

⁵⁴ CTIA Comments, at page 18.

⁵⁵ NOI Section 208, at pages 73-74, emphasis added.

⁵⁶ CTIA Comments, at page 12.

⁵⁷ *Id.*, at page 12, footnote 61, citing “RF Order II” – *In re Procedures for Reviewing Request for Relief from State and Local Regulations*, Order, 12 FCC Rcd 13494, 13496 (1997).

⁵⁸ CTIA Comments, at page 26.

⁵⁹ See Volkow N., footnote 50, *supra*.

⁶⁰ TIA Comments, at page 19.

claims, that the consensus view is that the FCC's standards "are overly protective."⁶¹ In fact, GAO stated the opposite: "By not formally reassessing its current limit, FCC cannot ensure it is using a limit that reflects the latest research on RF energy exposure."⁶²

Commenters also suggest that—since adverse health effects from RF energy have not yet been conclusively proven and the scientific community is not uniformly in agreement—there is no risk, and that health effects from RF energy will never exist.⁶³ This is despite the fact that cell phones are relatively new technology and widespread cell phone use has only been around for the past 10-15 years, the first iPhone was only released in 2007, adoption of cell phones by children is a very recent phenomenon, and brain cancer has a long latency period, and research data on long-term cell phone use is very limited (for 10-15 years) or does not exist (for >15 years). Even *known* carcinogens such as tobacco and outdoor air pollution took decades or more to manifest themselves in "proven" health impacts.⁶⁴

By (among other things) citing a 50X safety factor that is based on 20-year-old science and mischaracterizing the state of the science today, commenters hope that FCC

⁶¹ CTIA Comments, at page 2.

⁶² GAO Report, Highlights page.

⁶³ For example CTIA states, "*without any scientific evidence that the current rules pose any danger to human health, there is no need for additional regulation in the area of consumer 'disclosures' or encouraging consumers to limit their exposure to RF emissions.*" CTIA Comments, at page 15.

⁶⁴ Dr. Christopher Wild, Director of the IARC, has stated: "Often we're looking at two, three or four decades once an exposure is introduced before there is sufficient impact on the burden of cancer in the population to be able to study this type of question." *Quoted in* Kelland, K. and Nebehay, S., *Air Pollution is a Leading Cause of Cancer*, Scientific American, October 17, 2013, available online at <http://www.scientificamerican.com/article.cfm?id=air-pollution-a-leading-cause-of-ca>. Similarly, cigarettes had existed in the United States in crude form since the early 1600's and became widely popular after the Civil War. By 1944, the American Cancer Society began to warn about possible ill effects of smoking, although it admitted that "no definite evidence exists" linking smoking and lung cancer. In 1964, a report by the Surgeon General's Advisory Committee on Smoking and Health concluded: "Cigarette smoking is causally related to lung cancer in men." In 1965, Congress passed the Federal Cigarette Labeling and Advertising Act requiring the Surgeon General's warnings on all cigarette packages.

will do what industry itself has avoided doing—unqualifiedly designate devices as safe; make no further changes to the testing guidelines; provide no further information to consumers; and conclude that further time spent on this proceeding has little utility. The FCC should not take the bait. Unless and until the science can demonstrate that cell phones are safe to a reasonable scientific certainty, the FCC must expeditiously modify the device testing guidelines, in order to better protect and inform consumers.

E. Courts Have Not Ruled on the Merits of the FCC’s RF Exposure Standards

Commenters’ suggestions that federal courts have already ruled on the merits of these issues go too far. CTIA claims that “[t]wo different courts of appeal rejected petitions for review arguing that the adopted standards did not adequately protect the public.”⁶⁵ These courts, however, did not address the merits of the FCC’s RF exposure standards *per se* but, instead, dismissed the claims under the courts’ highly constrained standard of review. In *Cellular Phone Taskforce v. FCC*⁶⁶, for example, petitioners sought among other things to invalidate the very FCC guidelines under review in the NOI. The court articulated the standard of review for these claims, as follows:

The agency’s action should only be set aside where it relied on factors which Congress has not intended it to consider, entirely failed to consider an important aspect of the problem, offered an explanation for its decision that runs counter to the evidence before the agency, or is so implausible that it could not be ascribed to a difference in view or the products of expertise.⁶⁷

Viewed in this light, the court held that the FCC’s actions were not “arbitrary or

⁶⁵ CTIA Comments, at page 13. See footnotes 63-65 therein.

⁶⁶ *Cellular Phone Taskforce v. FCC*, 205 F.3d 82 (2d Cir. 2000).

⁶⁷ *Id.*, citing *Motor Vehicle Mfrs. Ass’n v. State Farm Auto. Ins. Co.*, 463 U.S. 29, 43, 103 S. Ct. 2856, 77 L.Ed.2d 443 (1983) (internal quotation marks omitted).

capricious” within the terms of the Administrative Procedures Act.⁶⁸

Likewise, in *EMR Network v. FCC*⁶⁹, the court dismissed the petitioners’ challenge of the FCC’s decision not to regulate non-thermal RF radiation effects, inasmuch as the FCC’s actions were not “arbitrary, capricious, an abuse of discretion, or otherwise not in accordance with law.”⁷⁰ The court expounded:

Presumably later actions pursuant to the [regulatory] plan might be significant enough to require [National Environmental Policy Act] filings, just as some FCC actions relating to RF radiation will need new environmental studies — including, for example, the circumstances where the current regulations call for such studies. But the regulations having been adopted, there is at the moment no “ongoing” federal action, . . . and no duty to supplement the agency’s prior environmental inquiries.⁷¹

The current proceedings are, of course, “ongoing” and altogether different in scope, and aspire to achieve more than what is simply not “implausible, arbitrary, or capricious.”

Pong, in sum, does not assert that cell phones are “unsafe” (as that notion, too, remains unestablished), but holds the scientifically-grounded view that *less exposure* to cell phone radiation—at any level that is possibly harmful—is “*safer*” than more, pending reasonably conclusive proof that human exposure to RF radiation under actual operating positions and conditions is not harmful in any respect. The FCC should advise consumers to exercise caution in this regard, instead of (albeit in the “code” language of the SAR standard) stating—for the industry, as it will not do itself—that cell phones are “safe.”

⁶⁸ Administrative Procedure Act (“APA”), 5 U.S.C. §500 *et seq.*

⁶⁹ *EMR Network v. FCC*, 391 F.3d 269 (D.C. Cir. 2004).

⁷⁰ *Id.*, citing the APA, 5 U.S.C. §706(2)(A).

⁷¹ *Id.*, citations omitted.

II. THE FCC SHOULD DISMISS ASSERTIONS THAT CURRENT FCC GUIDELINES ACCURATELY MEASURE CHILDREN’S EXPOSURE TO RF ENERGY. THE FCC’S TESTING GUIDELINES SHOULD BE MODIFIED TO BETTER PROTECT CHILDREN.

Pong previously has cited evidence in this docket that children in fact absorb substantially greater levels of RF energy than adults.⁷² Pong also noted in its comments that the SAM model used for testing of wireless devices does not adequately model for use of devices by children.⁷³ Other commenters also cited studies and provided extensive evidence, demonstrating that children absorb far more RF energy than do adults, and that the SAM model underestimates true radiation absorption by children.⁷⁴ A substantial body of evidence has been entered in the record in this proceeding, militating for changes to the FCC’s testing regime, as they relate to children.

Commenters who oppose modifications to the current standard generally rely on statements, for example from IEEE dating to 1991,⁷⁵ as well as on FDA statements on its web site that “[t]he scientific evidence does not show a danger to any users of cell phones

⁷² Pong Comments, at pages 6-10.

⁷³ *Id.*, at pages 8-10.

⁷⁴ See EWG Comments, at pages 3-9, and AAP Comments. AAP notes, “Current FCC standards do not account for the unique vulnerability and use patterns specific to pregnant women and children. It is essential that any new standard for cell phones or other wireless devices be based on protecting the youngest and most vulnerable populations to ensure they are safeguarded throughout their lifetimes.” And again, “Many children, adolescents and young adults, now use cell phones as their only phone line and they begin using wireless phones at much younger ages. Pregnant women may carry their phones for many hours per day in a pocket that keeps the phone close to their uterus. Children born today will experience a longer period of exposure to radio-frequency fields from cellular phone use than will adults, because they start using cellular phones at earlier ages and will have longer lifetime exposures. FCC regulations should reflect how people are using their phones today.” *Id.* See also Filing of Dr. Om P. Gandhi dated August 24, 2013 in Docket 13-84, at <http://apps.fcc.gov/ecfs/document/view?id=7520945322>.

⁷⁵ For example, TIA notes: “The current FCC, IEEE, and ICNIRP standards all have been determined by the expert groups that developed them and by independent expert panels to provide a substantial margin of safety—up to fifty-fold—for users of consumer RF devices. See, e.g., IEEE Standards Coordinating Committee 28 on Non-Ionizing Radiation Hazards, ‘IEEE Standard for Safety Levels With Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 400 GHz,’ at 28 (Sept. 26, 1991).” TIA Comments, at page 7.

from RF exposures, including children and teenagers.”⁷⁶

But among other things, these general and dated pronouncements directly contradict the very purpose of this proceeding, which is to update the record given that: (a) much time has passed since the FCC’s standards were developed in 1997; (b) much research has been concluded since 1997, including research that shows possible risks; and (c) much research remains to be done. Further, these pronouncements contradict other statements, from FDA itself and other organizations, including the GAO.⁷⁷

But whatever FDA’s web site might state, the facts are that extensive scientific evidence demonstrates that children absorb substantially more RF energy than adults, and that the SAM model does not adequately account for children. Further, while some scientific studies have shown potential health risks, and other studies have not demonstrated risk, thus far the science has not been able conclusively to determine that cell phones are, in fact, safe.

One commenter notes, “For years, SAM has been the preferred method and the industry standard for compliance,” that it is the “only specifically approved method for demonstrating compliance with RF standards” and “time-tested.”⁷⁸ But these general statements do not address the extensive evidence submitted in the record, that SAM (and the testing regime as a whole) should be modified better to account for use of devices by children. In the NOI, the FCC “ask[s] that commenters provide specific data and information,” and emphasizes that “[v]ague or unsupported assertions regarding costs or

⁷⁶ *Id.*, at page 25.

⁷⁷ See footnote 51, *supra*.

⁷⁸ CTIA Comments, at page 53.

benefits generally will receive less weight and be less persuasive than the more specific and supported statements.”⁷⁹ The FCC must give weight to the extensive evidence already presented in this proceeding regarding the need to better account for use of wireless devices by children in the FCC’s testing regime.

As we previously noted, use of wireless devices by children has skyrocketed since the FCC first developed its testing guidelines in 1997. Teens generally keep their devices on their persons (in so-called “body-worn configurations”) for extensive exposure periods, indeed for hours per day, and even sleep with their phones on their beds or under their pillows.⁸⁰ Common Sense Media, in fact, has recently reported that, among children under 2 years of age, 38% had used mobile devices—the same share as children 8 and under who had used such technology just two years ago.⁸¹ According to this report:

The amount of time spent using these devices has tripled [in two years], from an average of [five minutes] a day among all children in 2011 up to [fifteen minutes] a day in 2013. . . . The difference in the average time spent with mobile devices is due to two factors: expanded access, and the fact that those who use them do so for longer periods of time. Among those who use a mobile device in a typical day, the average went from [43 minutes] in 2011 to [1 hour and 7 minutes] in 2013.⁸²

For context, the Interphone study showed a 40% increased risk of glioma in adults described as “heavy users” of cell phones—a metric that then equated to just 27 minutes

⁷⁹ NOI, Section 209, at page 74.

⁸⁰ <http://children.webmd.com/features/children-and-cell-phones>. Pew reports 84% of teens sleep with their cell phones on or close to their beds. *See* http://www.pewinternet.org/~media/Files/Reports/2010/PIP_Adults_Cellphones_Report_2010.pdf, at page 22.

⁸¹ Common Sense Media, *Zero to Eight—Children’s Media Use in America 2013*, Fall 2013, available at <http://www.common Sense Media.org/sites/default/files/research/zero-to-eight-2013.pdf>.

⁸² *Id.*, at page 9.

of use per day.⁸³ Children, one must recall, absorb *between 1.5 to 10 times more* RF radiation than adults under similar exposures.⁸⁴

In our September 3, 2013 filing in this docket, we recommended that, with respect to children, the FCC should develop a more appropriate testing methodology that would—among other things—more accurately measure children’s “real SAR”; and we provided examples of how the FCC could accomplish this end.⁸⁵ The extensive evidence presented in the record of this proceeding supports such modifications by the FCC.

III. THE FCC SHOULD DISMISS SUGGESTIONS THAT PROXIMITY REQUIREMENTS WITH RESPECT TO THE FCC’S CURRENT TESTING REGIME ACCURATELY MEASURE TRUE RADIATION ABSORPTION BY USERS. THE RECORD DEMONSTRATES THAT THE FCC SHOULD MODIFY ITS TESTING GUIDELINES TO ACCOUNT FOR ZERO SPACING, WHICH IS HOW CONSUMERS NORMALLY USE DEVICES.

The record in this proceeding demonstrates that the FCC’s current testing guidelines, which permit testing at up to 25 cm distance in body-worn configuration, do not accurately measure true radiation absorption by users, including children, and that the proximity requirements for testing should be modified to include a zero spacing requirement. In our September 3, 2013 filing, we provided extensive testing data demonstrating how SAR substantially exceeds the FCC’s safety limits when devices are held adjacent to the body in body-worn configuration, which is how most consumers carry devices.⁸⁶

The GAO Report called for the FCC to update its portable device radiation

⁸³ See Section I.D, *supra*.

⁸⁴ See Section I.C, *supra*.

⁸⁵ Pong Comments, at page 10.

⁸⁶ *Id.*, at pages 11-16.

exposure and testing guidelines. According to the GAO Report, current FCC standards—in place since 1997 (some 4 years before the first smartphones became commercially available)—“*may not reflect the latest research,*”⁸⁷ “*may not identify maximum exposure [to radiation] in all possible usage conditions,*”⁸⁸ and do not test for use of phones against the body, which “*could result in RF energy exposure higher than the FCC limit.*”⁸⁹ GAO noted that current testing guidelines exclude testing against the body and may, therefore, underestimate true radiation absorption. GAO stated:

By not formally reassessing its current limit, FCC cannot ensure it is using a limit that reflects the latest research on RF energy exposure. FCC has also not reassessed its testing requirements to ensure that they identify the maximum RF energy exposure a user could experience. **Some consumers may use mobile phones against the body, which FCC does not currently test, and could result in RF energy exposure higher than the FCC limit.**⁹⁰

In spite of the evidence, one commenter states that it “does not believe a zero-spacing measurement requirement would accurately mimic real usage or increase safety.”⁹¹ As we noted in our September 3, 2013 filing, even a leading device manufacturer conceded that the FCC’s SAR limit is likely exceeded when consumers carry devices in normal fashion—i.e., in their pockets; which is how most consumers carry devices. An Apple iPhone manual states:

⁸⁷ GAO Report, *Highlights* page, emphasis added.

⁸⁸ *Id.*, emphasis added.

⁸⁹ *Id.*, emphasis added. The GAO Report states: “Some consumers may use mobile phones against the body, which FCC does not currently test, and could result in [radio frequency (“RF”) energy exposure higher than the FCC limit.” Further, the GAO Report observes: “Some consumer groups noted that they would like FCC to mention the IARC’s recent classification of RF energy exposure as ‘possibly carcinogenic’ on FCC’s website.” *Id.*, at page 26.

⁹⁰ *Id.*, *Highlights* section, emphasis added.

⁹¹ CTIA Comments, at page 17.

iPhone’s SAR measurement may exceed the FCC exposure guidelines for body-worn operation if positioned less than 15 mm (5/8 inch) from the body (e.g., **when carrying iPhone in your pocket**).⁹²

In spite of the extensive evidence in the record, one commenter opposed to changes to proximity in testing, noted the following:

Furthermore, operation of devices much closer to, or in actual contact with, the body may degrade performance. Therefore, testing devices that are operating too close to the body may result in antenna performance being negatively affected. Testing should be performed in configurations that allow the device to operate properly. The fact that consumers may occasionally use their devices in suboptimal physical configurations—of which there an infinite variety—should not require testing that would mimic every conceivable configuration.”⁹³

This comment essentially proves the point that testing should be conducted at zero spacing. First, as the commenter notes, it is true that “operation of devices much closer to, or in actual contact with, the body may degrade performance.” It is also true, as the commenter notes, that “testing devices that are operating too close to the body may result in antenna performance being negatively affected.” But these observations beg the question: why does operation of a device closer to or in actual contact with the body degrade performance? And why does testing of devices “too close to the body” result in antenna performance being negatively affected? The answer, is that, at closer proximities to the body—which is how most consumers use devices—*between 48% and 68% of the*

⁹² See http://manuals.info.apple.com/en_US/iPhone_3G_Important_Product_Information_Guide.pdf, at page 7, emphasis added. This warning appeared in the online version of the guide for the 3GS model (downloaded on June 3, 2013), but did not appear in the online versions of the Guides for the iPhone 4, 4S, 5, or 5S models.

⁹³ CEA Comments, at page 13.

*RF energy from the device is absorbed into the head, brain or body.*⁹⁴ As such, of course the performance of the device will be adversely affected, since RF energy does not propagate into the far field to communicate with a cell tower, but rather is absorbed into the head or body of the user.

The next sentence by the commenter—i.e., that “testing should be performed in configurations that allow the device to operate properly”—completely mischaracterizes what the FCC designed its testing guidelines to achieve. The FCC intended to replicate *normal operating positions or conditions*—as consumers ordinarily use such devices—and not how a manufacturer or industry group would like those devices to be used in a fictitious setting, or to achieve artificial, unrealistic test results. Similarly the statement that consumers “occasionally use their devices in suboptimal physical configurations—of which there an infinite variety”—is obfuscatory and mischaracterizes how consumers normally use devices—which again, very simply, is directly against their bodies in body-worn configuration for many hours throughout the day.

Another commenter similarly posits: “A phone’s antennas perform best when the antennas are not directly adjacent to a body, due to dielectric loading from the body.”⁹⁵ Again, “dielectric loading from the body” is simply abstruse, scientific terminology that describes what (unbeknownst to most consumers) is actually occurring when they use their device in normal fashion (i.e., very close to or touching the body): RF energy from the device is absorbed into the head or body, rather than propagating into free space and

⁹⁴ See, e.g., Nielsen, J.O. and Pedersen, G.F., “Mobile Handset Performance Evaluation Using Radiation Pattern Measurements,” IEEE Transactions on Antennas and Propagation, Vol. 54, No. 7, July 2006, <http://vbn.aau.dk/files/7274376/01650415.pdf>.

⁹⁵ TIA Comments, at page 25.

communicating with the cell tower. The commenter similarly concedes that, because of this dynamic, when a consumer uses the device in its intended manner close or adjacent to the body, “*performance is compromised as a phone approaches zero separation.*”⁹⁶

The commenter concludes,

Thus, testing procedures that are revised and reoriented toward decreased spacing will compel redesigned products that either: (1) *have shorter ranges* for optimum performance, or (2) have features that limit performance capabilities by *limiting power and/or transmissions* when the product is being carried on the body.”⁹⁷

It is important to note in light of TIA’s comments that, first, 8 days after TIA’s filing, Apple released its flagship iPhone 5S smartphone, which does exactly what TIA cautioned against in this proceeding: it includes “features that limit performance capabilities by limiting power and/or transmissions when the product is being carried on the body.” The following table from Apple’s SAR Evaluation Report for the iPhone 5S⁹⁸ describes this architecture:

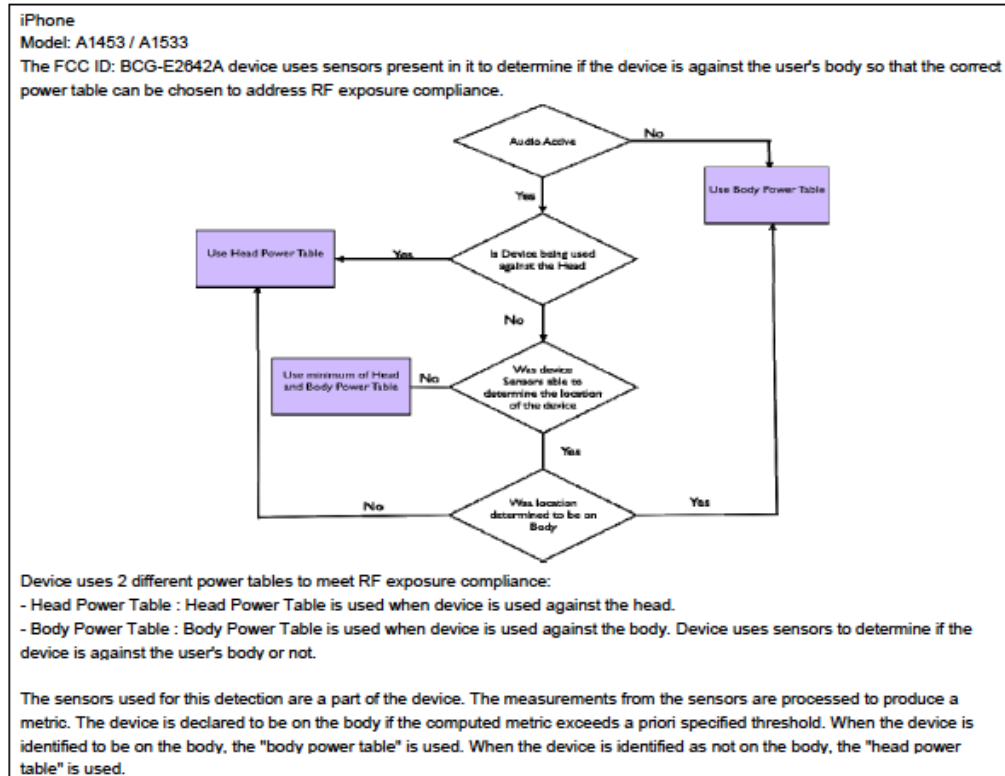
⁹⁶ *Id.*, emphasis added.

⁹⁷ *Id.*, emphasis added.

⁹⁸ SAR Evaluation Report for iPhone Model A1453/A1533, FCC ID: BCG-E2642A, Report #13U14987-22C, prepared for Apple Inc. by UL Verification Services, Inc., September 5, 2013, at page 16.

7. Device Under Test

7.1. General Information



As this report notes:

[The iPhone 5S] uses sensors present in it to determine if the device is against the user's body so the correct power table can be chosen to address RF exposure compliance.⁹⁹

While not entirely clear from the Report, the proximity sensors in the iPhone 5S appear to enable the antenna to detect impedance changes from its surroundings, i.e., when next to a body.

Pong has determined, however, that the "sensing" antenna is also influenced by

⁹⁹ *Id.*

other proximate solids, including cases—even Apple’s own “precisely designed” and “precision crafted”¹⁰⁰ case for the iPhone 5S. Impedance changes to the antenna resulting from the presence of a case, in turn, affects antenna performance by reducing transmitted signal or “Total Radiated Power” (“TRP”)¹⁰¹ on some channels and increasing SAR on others. These results vary unpredictably from case to case, *except for Pong’s case that increases outbound signal compared to other cases and decreases SAR*. Put another way, the OEM case from Apple—as well as other after-market cases—can negatively impact cellular performance for the iPhone 5S and can *increase*, rather than “address,” consumers’ exposure to RF radiation.¹⁰² But although these cases are sold by Apple as the OEM of the corresponding device—and, so, “supplied or designated for this product” within the terms of current FCC regulations¹⁰³—they need **not** (unlike belt clips and holsters) be tested “*with the [accessory] attached to the device and positioned against a flat [SAR-testing] phantom in normal use configurations.*”¹⁰⁴ Because the “radiation profile” of a given device with a case may bear little resemblance to that of the same device without a case, the failure to account for cases may eviscerate the entire equipment authorization process.

¹⁰⁰ <http://store.apple.com/us/product/MF045LL/A/iphone-5s-case-black?fnode=47>.

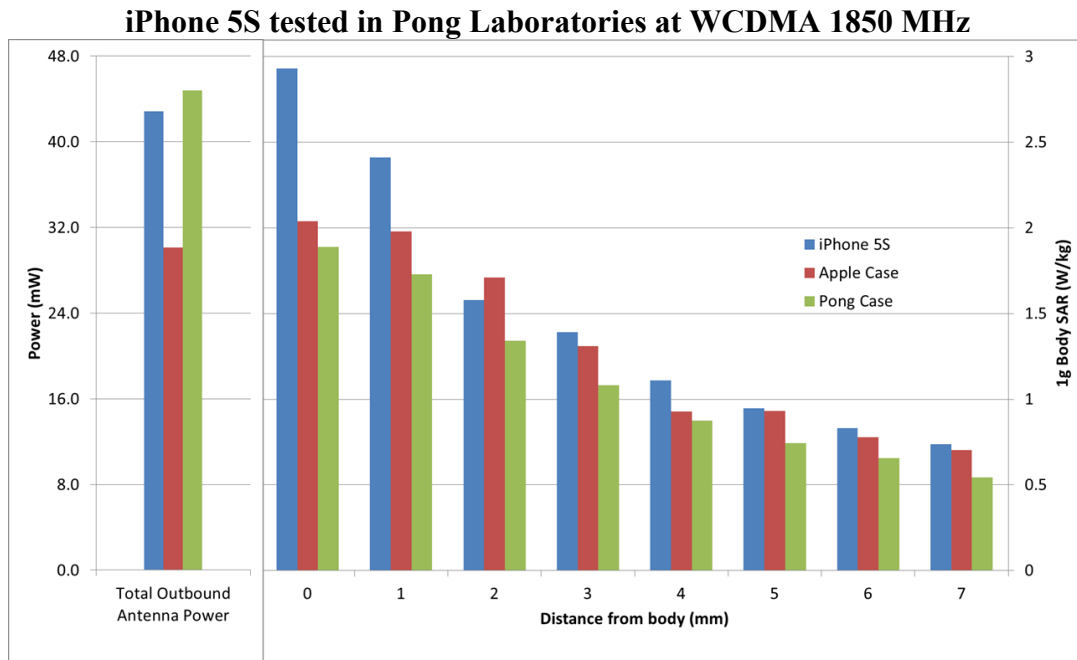
¹⁰¹ TRP measures signal strength of the portable device itself, while Total Isotropic Sensitivity or “TIS”—typically shown by “bars” on a device’s graphic user interface—measures inbound signal from a cell tower to the device.

¹⁰² The FCC has expressly acknowledged that the presence of accessories will “affect the SAR produced by the transmitting device,” and that “the physical spacing to the body of the user as dictated by the accessory and the materials used in an accessory affect the SAR produced by the transmitting device.” Supplement C, at page 41.

¹⁰³ *See id.* With great foresight, the FCC anticipated that consumers might procure accessories like belt clips and holsters not only from OEMs but also in the aftermarket. Although no meaningful aftermarket for accessories such as cases existed in 2001, the FCC indicated that OEMs like Apple should caution consumers that “[u]se of other [non-OEM] accessories may not ensure compliance with FCC RF exposure guidelines.” *Id.*, at page 41.

¹⁰⁴ *Id.*

The chart below illustrates these points.¹⁰⁵

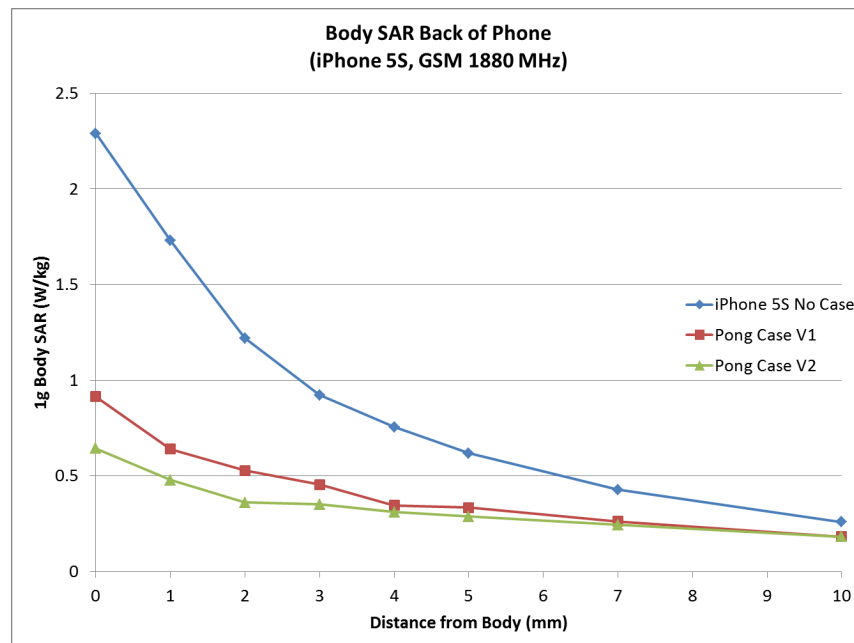


When the Apple case is attached to the iPhone 5S, TRP decreases because of the proximity sensor architecture and antenna sensitivity and, as one would expect, so does SAR. But with a Pong case, outbound signal is *not* reduced although SAR decreases substantially below the levels shown in both the “bare” iPhone 5S and Apple case scenarios. It is important in this context to remember that radiated power is a function of the source antenna only, *not* distance from the antenna. As the signal travels further from

¹⁰⁵ Pong tested the iPhone 5S in this example at WCDMA 1850 MHz. The increased SAR profile in actual use might even exceed the “theoretical” assumptions that inform the Commission’s safety standard of 1.6 W/kg. This result could obtain because the efficiency of an antenna depends on the impedance of its surrounding medium. Cellular antennas are typically designed to operate surrounded mostly by air. Changing the material surrounding the antenna—for example, with a case—can alter the impedance match and affect the antenna’s efficiency. In some scenarios (dependent on frequency and dielectric properties) efficiency can be improved, so that the antenna radiates more power. The addition of a case to a device, however, could change antenna efficiency and increase radiated power, so that the safety limit is violated. In any event, the stated SAR rating of a device for purposes of its equipment authorization would differ from its actual SAR emission with the addition of a form-fitting case. The fact that consumers generally use their devices against their heads and bodies—again, contrary to the assumptions that underlie both the Commission’s safety standard and equipment authorization testing regulations—would exacerbate this state of affairs.

the source it spreads in out in space, so that the intensity at any fixed point in space is reduced, but the sum of the field in all space (or *total* power) remains constant.

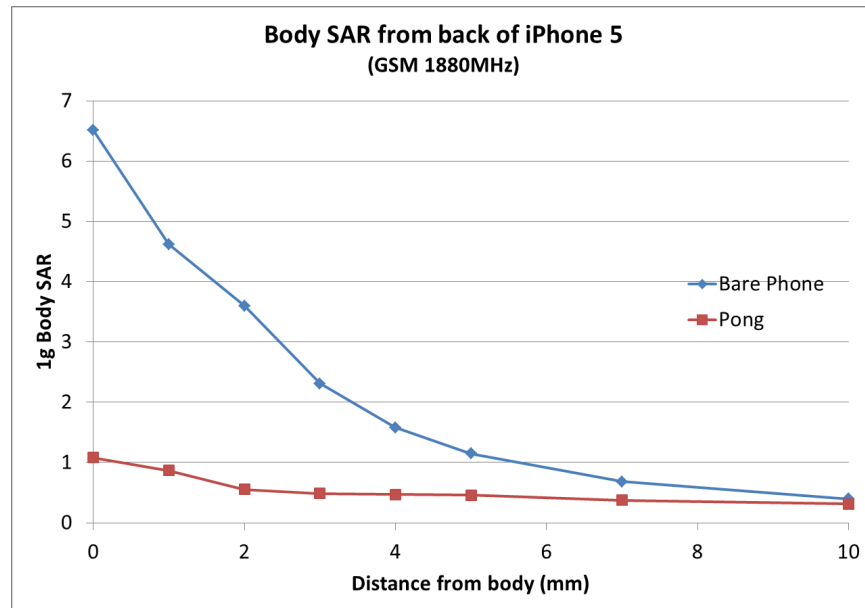
While a Pong case benefits outbound signal, it dramatically reduces SAR—especially at the “normal operating position” of “zero distance.” The graph below illustrates the impact on body SAR of two versions of the Pong case versus a bare iPhone 5S, measured at up to “zero distance” from the back of the smartphone. With a Pong case, SAR remains substantially below the current standard of 1.6 W/kg, while the iPhone 5S itself exceeds the limit at 1 mm.



The iPhone 5S achieves even these results, however, at the expense of TRP—due to its proximity sensor architecture and antenna sensitivity, as described above. Results are more dramatic for the iPhone 5 that lacks these elements.

The iPhone 5 under the same conditions exceeds FCC safety limits at up to 4 mm and, at “zero distance,” **demonstrates SAR of 6.5 or more than 4 times the current**

safety limit. With a Pong case, however, iPhone 5 SAR remains nearly 40% *below* the limit, even at “zero distance”—and *6.5 times less* than that of a bare iPhone 5.

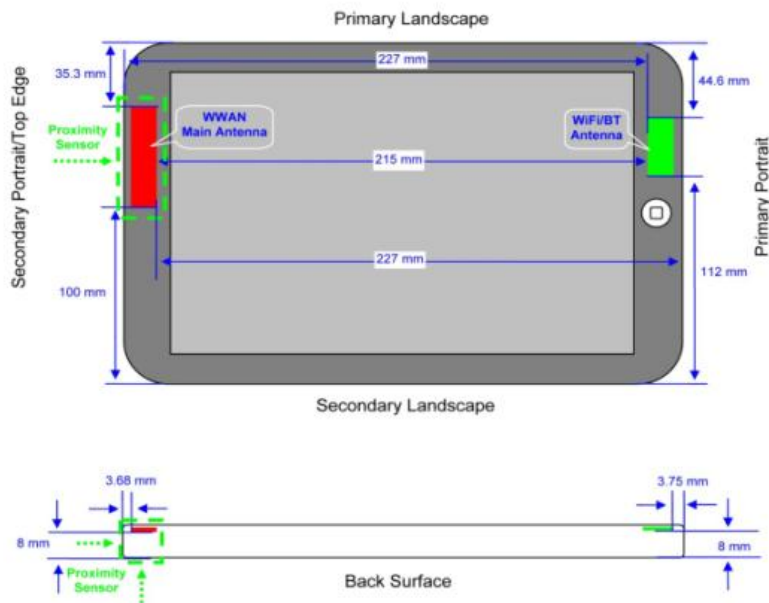


Apple uses a proximity sensor architecture similar to that of the iPhone 5S for its leading tablet product, the iPad.¹⁰⁶ In its SAR Evaluation Report for the iPad 2¹⁰⁷, for example, Apple disclosed the following:

¹⁰⁶ WIRED magazine independently investigated the proximity sensor architecture’s impact on iPad performance, both with and without a Pong case. See Phillips, J., *Can a \$100 iPad Case Improve 3G Data Power? Lab Test!*, WIRED.com, December 15, 2011, <http://www.wired.com/gadgetlab/2011/12/pong-ipad-case-investigation>.

¹⁰⁷ SAR Evaluation Report for iPad Model A1396, FCC ID: BCGA-1396, Report #10U13582-1B, prepared for Apple Inc. by Compliance Certification Services, Inc., March 1, 2011, at page 45.

16. ANTENNAS LOCATIONS AND SEPARATION DISTANCES



A subsequent report¹⁰⁸ for a later iPad version similarly noted:

6. Proximity Sensor Operation

A Proximity sensor for power reduction is implemented in this device to address RF exposure compliance when the cellular antenna is positioned close to the user's body. The sensor mechanical structure is designed to fit within the enclosure design used in this device and also extended around the edge and top of the antenna element in order to optimize sensitivity in these orientations. This design combines the antenna and proximity sensor into a single FPC (Flexible Printed Circuit).

6.1. Description

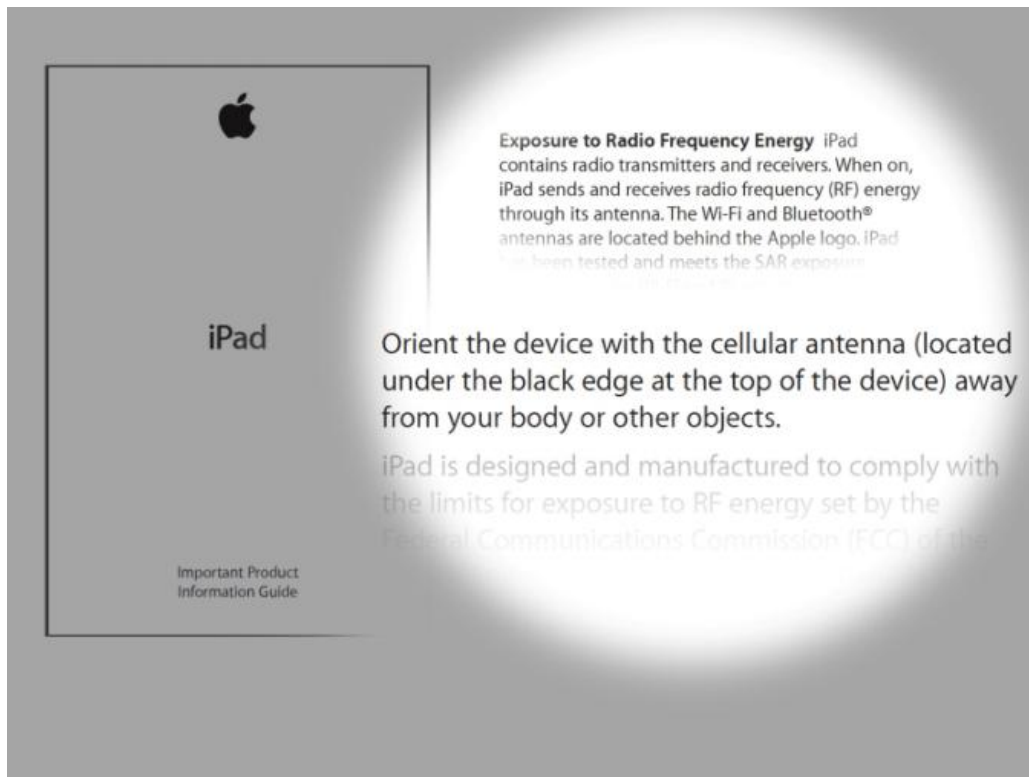
The device, model A1430, utilizes a capacitive proximity sensor built into the plastic area that houses the cellular radio antenna. This area can be found on the top edge and the front/Rears of the device, when the device is oriented in the portrait orientation and the I/O port is at the bottom. The purpose of the proximity sensor is to cap the transmitter output power when the device's cellular antenna is proximate to the human body.

For design and testing purposes Top-Edge, Front Surface, and Rear are chosen as the dimensions of interest. The minimum detection distances for these dimensions are: 14 mm (Top-Edge), 14mm (Front), and 11 mm (Rear)

Commensurate with other caution statements to the effect that consumers should not

¹⁰⁸ SAR Evaluation Report for iPad Model A1430, FCC ID: BCGA-1430, Report #12U14315-2, prepared for Apple Inc. by Compliance Certification Services, Inc., March 12, 2012, at page 16.

place cellular antennas proximate to their bodies¹⁰⁹, Apple advised:



Like Apple’s case for the iPhone 5S, Apple also produces a “Smart Cover” for the iPad. On Apple’s web site, it states, “*The Smart Cover and iPad work so well together, it’s easy to think of them as one device.*”¹¹⁰ The web site notes, “*We designed iPad to work with the Smart Cover — and the other way around.*”¹¹¹ Various characteristics are promoted on the web site, including looks, colors, and comfortable typing position. In addition to these functional and aesthetic characteristics however, the Smart Cover also happens to trigger the iPad’s proximity sensor, causing material reductions in TRP in scenarios wherein the iPad is actually *not* proximate to a human body but merely enclosed in a case. Similar results occur with every other after-market iPad case, *except*

¹⁰⁹ See, e.g., footnote 92, *supra* (citing warnings in the iPhone manual).

¹¹⁰ See <http://www.apple.com/ipad/smart-cover/>.

¹¹¹ *Id.*

for the Pong case. Apple itself discloses¹¹² that, a result of the proximity sensor, iPad TRP can drop as much as 10 dB—a 90% power loss:

REPORT NO: 11U14054-4B
FCC ID: BCGA1430

DATE: February 13, 2012
IC: 579C-A1430

Results

Band	Mode	UL Ch No.	Freq. (MHz)	MPR	Tx Conducted Pwr (dBm)	
					W/o Pwr back-off	W/ Pwr back-off
UMTS (WCDMA) Band V	Subtest 1	4357	826.4	0	24.7	19.2
		4408	836.6	0	24.6	19.1
		4458	846.6	0	24.4	18.9
	Subtest 2	4357	826.4	2	22.8	17.3
		4408	836.6	2	22.6	17.1
		4458	846.6	2	22.8	17.3
	Subtest 3	4357	826.4	1	23.5	18.0
		4408	836.6	1	23.5	18.0
		4458	846.6	1	23.4	17.9
	Subtest 4	4357	826.4	2	23.2	17.7
		4408	836.6	2	23.1	17.6
		4458	846.6	2	23.2	17.7
	Subtest 5	4357	826.4	0	24.5	19.0
		4408	836.6	0	24.5	19.0
		4458	846.6	0	24.6	19.1
UMTS (WCDMA) Band II	Subtest 1	9262	1852.4	0	22.8	14.8
		9400	1880.0	0	22.7	14.7
		9538	1907.6	0	22.7	14.7
	Subtest 2	9262	1852.4	2	20.8	12.8
		9400	1880.0	2	20.7	12.7
		9538	1907.6	2	20.9	12.9
	Subtest 3	9262	1852.4	1	21.8	13.8
		9400	1880.0	1	21.8	13.8
		9538	1907.6	1	21.8	13.8
	Subtest 4	9262	1852.4	2	20.9	12.9
		9400	1880.0	2	20.8	12.8
		9538	1907.6	2	20.8	12.8
	Subtest 5	9262	1852.4	0	22.8	12.8
		9400	1880.0	0	22.8	12.8
		9538	1907.6	0	22.8	12.8

These results correspond to the following performance characteristics of the iPad with a Smart Cover or other case¹¹³ versus a Pong case:

¹¹² SAR Evaluation Report for iPad Model A1430, FCC ID: BCGA-1430, Report #11U14054-4B, prepared for Apple Inc. by Compliance Certification Services, Inc., February 13, 2012.

¹¹³ The Smart Cover does is not designed for the iPad 1, but only for later versions.

Device	Proximity Sensor Power Reduction (dB)	Proximity Sensor Power Reduction (%)	Proximity Sensor Range Reduction (%)	Pong Improvement in Signal Strength	Pong Improvement in Range
iPad 1	8.5	85.9	62.4	7.1X	2.7X
iPad 2 (Verizon)	7	80.0	55.3	5.0X	2.2X
iPad 2 (AT&T)	6.2	76.0	51.0	4.2X	2.0X
New iPad (Verizon 3G)	7.5	82.2	57.8	5.6X	2.4X
New iPad (Verizon LTE/4G)	5.5	71.8	46.9	3.5X	1.9X
New iPad (AT&T 3G)	10	90.0	68.4	10.0X	3.2X
New iPad (AT&T LTE/4G)	8.2	84.9	61.1	6.6X	2.6X

At the same time, CETECOM Inc.—a “Telecommunications Certification Body”¹¹⁴—showed in its labs that the Pong case materially reduce SAR.

iPad 2			1g SAR (W/kg)		%	% Below
Network	Band	Frequency (MHz)	Without Pong	With Pong	Reduction	FCC Limit
	CDMA 850	836.5	1.3	0.515	60.4	67.8
Verizon	CDMA 1900	1850	0.809	0.279	65.5	82.6
	CDMA 1900	1880	0.783	0.293	62.6	81.7
	WCDMA 850	826.4	1.05	0.34	67.6	78.8

¹¹⁴ See www.cetecom.com. Pong tests its cases in third-party facilities (including CETECOM) certified by the FCC, and calibrates its own extensive equipment to these industry standards.

AT&T	WCDMA 850	836.6	1.33	0.454	65.9	71.6
	WCDMA 1900	1880	1.44	0.445	69.1	72.2
			10g SAR (W/kg)		%	% Below
	Band	Frequency (MHz)	Without Pong	With Pong	Reduction	ICNIRP Limit
International	WCDMA 850	826.4	0.556	0.202	63.7	89.9
	WCDMA 850	836.6	0.705	0.269	61.8	86.6
	WCDMA 2100	1950	0.641	0.229	64.3	88.6

Thus—contrary to one commenter’s concern that “testing procedures that are revised and reoriented toward decreased spacing will compel redesigned products that either: (1) *have shorter ranges* for optimum performance, or (2) have features that limit performance capabilities by *limiting power and/or transmissions* when the product is being carried on the body.”¹¹⁵—***technologies currently exist*** in the marketplace that obviate the need for wireless device proximity sensors that degrade performance of the device, as such devices should *not* “have shorter ranges for optimum performance.” For example, Pong’s cases *reduce* SAR while *increasing* TRP.

These results notwithstanding, another commenter cites as justification for not modifying the testing requirements to include zero spacing in body-worn configuration, an FCC statement in Section 251 of the NOI, that “we have no evidence that this poses any significant health risk.”¹¹⁶ But this statement from the FCC contravenes the facts.

¹¹⁵ TIA Comments, at page 25, emphasis added.

¹¹⁶ CEA Comments, at page 11, *quoting* NOI, Section 251.

There is extensive evidence of potential health risks already entered into the record in this proceeding. Further, and again, GAO reiterates that “insufficient information was available to conclude mobile phones posed no risk,” and that “FDA stated that while the overall body of research has not demonstrated adverse health effects, some individual studies suggest possible effects. Officials from NIH, experts we interviewed, and a working group commissioned by IARC—the World Health Organization’s agency that promotes international collaboration in cancer research—have reached similar conclusions. For example, in May 2011 IARC classified RF energy as “possibly carcinogenic to humans.”¹¹⁷ Moreover, FCC itself has acknowledged its lack of scientific and medical expertise to assess the health impacts of wireless devices, noting, “Since the Commission is not a health and safety agency, we defer to other organizations and agencies with respect to interpreting the biological research necessary to determine what levels are safe.”¹¹⁸

As discussed in Pong’s September 3, 2013 filing, most consumers today rely heavily on their portable devices, and use and carry them against their heads and bodies for increasingly longer periods—such that “body-worn configuration” has become not the exception but the norm, and that testing a device 15 mm or more away from the person (for body-worn configuration) misrepresents “real SAR.” The record irrefutably demonstrates that consumers are exposed, for long periods of time each day, to SAR levels in excess of the FCC safety limit. The FCC, therefore, must modify its testing guidelines to account for zero spacing, which is how consumers ordinarily use devices in body-worn configuration.

¹¹⁷ GAO Report, at pages 6-7.

¹¹⁸ NOI Section 6.

An additional recent development has sharpened this point. OEMs, including Apple and Samsung, have developed prototype “curved screens” for mobile devices that will contour more closely than flat screens to the user.¹¹⁹ In developing curved devices, OEMs effectively have acknowledged that consumers want and use devices directly against the body, which bolsters the argument that testing should be conducted at zero spacing. It should be noted, too, that—because body SAR testing is done on a flat phantom, the architecture of a curved device might raise the antenna even further from the testing surface and, thus, artificially underestimate “real SAR” even more. The FCC should account in its testing procedures for these trends and should, at a minimum, require caution statements that SAR measurements for a curved device taken on a flat phantom might not reflect SAR accurately.

We respectfully submit that, in order properly to protect consumers, the FCC should update its testing guidelines to reflect the use of devices directly against the body rather than at between 15 mm and 25 mm away.¹²⁰ Most consumers hold their devices against their bodies. A space of at least 15 mm or more dramatically reduces SAR, but that is not how consumers typically—or, in the FCC’s words, as a matter of “normal operating positions or conditions”¹²¹—use devices. Modern habits tend towards much closer proximities, as well as longer exposures.

¹¹⁹ See, e.g., <http://www.theverge.com/2013/10/8/4818572/samsung-galaxy-round-curved-oled-smartphone-official> (describing the Samsung Galaxy “Round” smartphone).

¹²⁰ Cf. Filing of Pong Research Corporation dated June 29, 2012 in WT Docket 11-186 and ET Docket 03-137, <http://apps.fcc.gov/ecfs/document/view?id=7021981415> (addressing distance standards).

¹²¹ Bulletin 65, at page 42.

IV. BASED ON SUBSTANTIAL EVIDENCE IN THE RECORD, THE FCC SHOULD CONCLUDE THAT DEVICE CERTIFICATION TESTING SHOULD ACCOUNT FOR ACCESSORIES THAT ARE COMMON TODAY, AND THAT SUBSTANTIALLY IMPACT RF ENERGY ABSORPTION—SPECIFICALLY CASES.

Extensive evidence has been submitted in the record in this proceeding,¹²² demonstrating that: (a) cases can dramatically impact the radiation properties of wireless devices,¹²³ indeed, even cases with non-metallic parts;¹²⁴ (b) in contrast to 1997 when the FCC established its device testing guidelines, and accounted for belt clips and holsters in the device testing guidelines¹²⁵ (including caution statements with respect to such accessories),¹²⁶ today most consumers use cases;¹²⁷ (c) most consumers are unaware that cases can dramatically impact the radiation properties of their wireless device;¹²⁸ and (d) by changing the radiation profile of the device, cases essentially eviscerate the purpose of the FCC’s device testing guideline, which is to simulate RF energy absorption by users of wireless devices during normal operating positions or conditions. Accordingly the FCC should conclude that the device testing guidelines must accommodate the presence of

¹²² Pong Comments, at pages 16-32.

¹²³ *Id.*

¹²⁴ *Id.*, at pages 27-32.

¹²⁵ Supplement C at page 41 states: “Body-worn operating configurations should be tested with the belt-clips and holsters attached to the device and positioned against a flat phantom in normal use configurations. Devices with a headset output should be tested with a headset connected to the device.”

¹²⁶ Bulletin 65 also stipulated cautionary statements in user manuals, specifically to the effect that *certain accessories may cause the portable device to exceed the Commission’s RF compliance requirements*. Bulletin 65 provided that “[I]n order for users to be aware of the body-worn operating requirements for meeting RF exposure compliance, operating instructions and caution statements should be included in the manual. The information should allow users to make informed decisions on the type of body-worn accessories and operating configurations that are appropriate for the device.” Bulletin 65 further provided specific examples of such statements, including a warning that use of certain accessories “*may not ensure compliance with FCC RF exposure guidelines.*” *Id.*

¹²⁷ Pong Comments, at page 24.

¹²⁸ EWG notes, “Due to variations in phone design and antenna placement, moreover, the modulation of the SAR value will be case- and phone-dependent. Currently, however, most consumers are unaware of this. The FCC provides zero information that consumers can use to guide their purchasing decisions.” EWG Comments, at pages 13-14.

accessories that are prevalent today—namely, cases.

V. THE FCC SHOULD REJECT ASSERTIONS THAT CONSUMERS SHOULD NOT BE PROVIDED MORE INFORMATION ABOUT WIRELESS DEVICE SAFETY.

In our September 3, 2013 filing, we noted that the FCC should update its guidelines so that consumers are provided more easily accessible information about how to reduce exposure to RF energy from wireless devices. Consumers typically remain unaware of the fine print in detailed user manuals, and therefore may not know that—by holding portable devices close to their bodies—they may be absorbing higher levels of radiation than the FCC’s safety limit permits. Ironically, within the parameters of the FCC’s RF exposure testing regulations, cell phones are governed by a so-called “general population/uncontrolled” tier—*a standard that assumes that users lack knowledge or control over potential exposure*. Because of that assumption, the safety standard dispenses with consumer warnings.¹²⁹ Yet some commenters erroneously reason that consumers remain adequately informed.

The GAO noted that user manuals typically “include a statement that, when used on the body, as opposed to against the ear, a minimum distance between the body and the mobile phone should be maintained. These distances ranged from 1.5 to 2.5 centimeters.”¹³⁰ However such statements, buried deep in device user manuals¹³¹ and FCC web site disclosures, do little to make consumers aware of potential risks and precautions. The purpose of disclosures and information is not to satisfy a legal

¹²⁹ See RF Order II, at pages 13504-05.

¹³⁰ GAO Report, at page 27.

¹³¹ For iOS 7, Apple’s disclosures regarding SAR testing appear within the software interface itself at Home>Settings>General>About>Legal>RF Exposure, at which point Apple links users to <http://www.apple.com/legal/rfexposure/iphone5,2/en/>.

obligation, but to make sure that consumers are aware. Accordingly, in our September 3, 2013 filing we recommended steps such as more prominent advisories, for example, at point of sale, on packaging, and on web sites, that would be easier for consumers to see.

One commenter in this proceeding noted that the FCC “should not mandate disclosure of SAR data of devices where emissions are below the general population RF exposure limit.”¹³² One of the problems with this premise is that, as we [and other commenters] have demonstrated in this proceeding, consumers are actually absorbing higher levels of SAR than the FCC limit, continuously, under normal operating positions or conditions. Our data, the GAO Report, and even the manuals of a leading manufacturer confirm this fact. Flawed FCC testing guidelines, and the continuous absorption of SAR levels by users above FCC limits, militate for a higher disclosure standard, particularly since most consumers are unaware of this exposure.

Another commenter who opposes providing additional consumer information states, “There is no scientific justification for mandating consumer information regarding RF exposure.”¹³³ The commenter proffers the view:

the FCC’s range of inquiry regarding consumer information as being on the verge of giving credence to areas of undue concern, particularly with regard to the questions about information for reducing RF exposure and the precautionary principle. TIA urges the FCC to be cautious about promoting the use of consumer information for reducing RF exposure and the precautionary principle: consumers often respond by believing there is a credible safety concern or else the issue would not be raised.¹³⁴

¹³² See CEA Comments, at page 6.

¹³³ TIA Comments, at page 13.

¹³⁴ *Id.*, at page 14.

First, the statement disavowing any “scientific justification for mandating consumer information regarding RF exposure” is inaccurate. The truth is, we do not know conclusively whether RF energy from wireless devices, is either safe or unsafe. But certainly numerous studies have drawn a link between RF energy and health impacts.¹³⁵ On this basis, the FCC has an obligation truthfully to tell consumers exactly that. As stated earlier, and as the GAO noted,

insufficient information was available to conclude mobile phones posed no risk. Following another decade of scientific research and hundreds of studies examining health effects of RF energy exposure from mobile phone use, **FDA maintains this conclusion. FDA stated that while the overall body of research has not demonstrated adverse health effects, some individual studies suggest possible effects. Officials from NIH, experts we interviewed, and a working group commissioned by IARC—the World Health Organization’s agency that promotes international collaboration in cancer research—have reached similar conclusions. For example, in May 2011 IARC classified RF energy as “possibly carcinogenic to humans.”**¹³⁶

Moreover, it would run counter to the public interest to withhold information that consumers are entitled to receive about RF energy, or to determine that consumers should not receive information because “consumers often respond by believing there is a credible safety concern or else the issue would not be raised.”¹³⁷ Another commenter states, in almost parental fashion, “Disclosures or advisories could confuse or alarm consumers about risks that do not exist, or worse yet numb them to warnings about risks

¹³⁵ See, e.g., footnotes 1, 3 and 39, *supra*.

¹³⁶ GAO Report, pages 6-7.

¹³⁷ TIA Comments, at page 14.

that do exist.”¹³⁸ Instead, consumers should be told the truth, and informed exactly where the science is today—which is as the GAO stated—that some (especially independently funded) studies indicate potential harms while others do not, and that neither the FCC nor any other agency can determine today with certainty that portable devices are either safe or unsafe—and, therefore, consumers should exercise reasonable precautions. The FCC has an obligation without bias to inform consumers, and to modify its guidelines accordingly.

As we and other commenters have noted, the 2011 World Health Organization/IARC report classified cell phone radiation as *possibly carcinogenic to humans*. In advocating against further disclosures to the American public, one commenter said this designation could be “distorted” by “alarmists”¹³⁹ and that the “uninitiated will tend to misunderstand this.”¹⁴⁰ The commenter then describes in contortionist fashion, their view on what the word “possibly” means:

The description “possibly carcinogenic” is oftentimes misunderstood, misused and misstated by consumers and advocates alike. Part of the confusion stems from the meaning of the word “possible.” In the IARC context, the term “possible” means “being something that may or may not occur or be true.” In other words, “possible” simply means not impossible. As the Chief of the National Cancer Institute’s Radiation Epidemiology Branch succinctly explained: possible in the IARC context just means “maybe.”¹⁴¹

These arguments essentially posit that the American people do not have the capacity to interpret for themselves what the word “possibly” means, do not have the

¹³⁸ CTIA Comments, at pages 41-42.

¹³⁹ *Id.*, at page 25.

¹⁴⁰ *Id.*, at page 43, footnote 196.

¹⁴¹ *Id.*, at pages 25-26.

right to be informed that a product is “possibly carcinogenic,” and that industry representatives are better suited to determine for the American people what information should or should not be disclosed. Such arguments contravene the public interest, and the FCC should reject them.

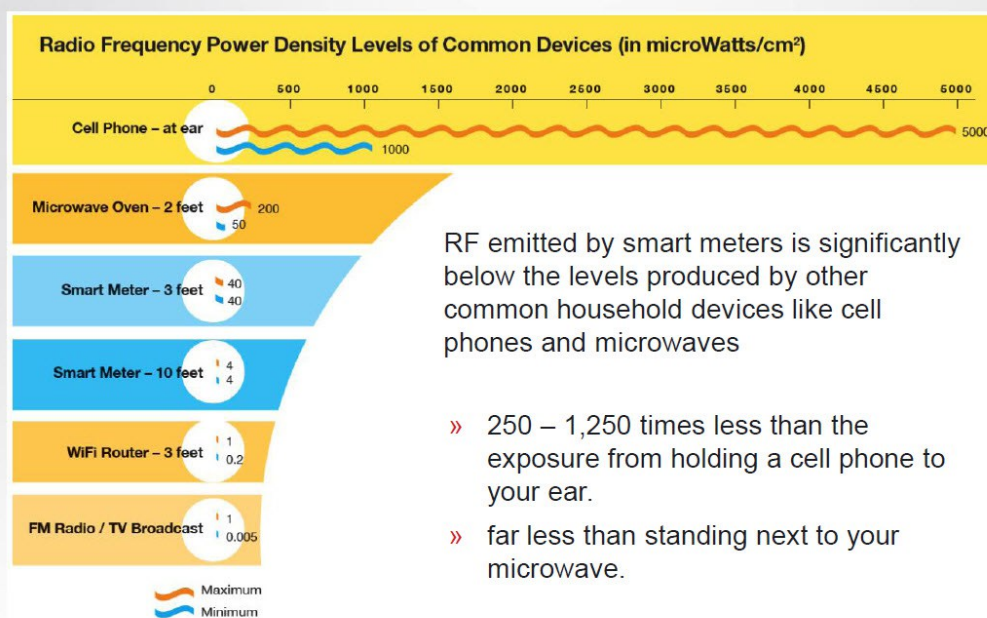
The FDA, in fact, has done just that in the instructive context of microwave ovens that subject consumers to far less RF exposure than cell phones. The FDA has the responsibility for carrying out an electronic product radiation control program mandated by the Electronic Product Radiation Control provisions of the Food and Drug Cosmetic Act.¹⁴² Through its Center for Devices and Radiological Health, FDA sets and enforces standards to ensure that radiation emissions do not pose a public health hazard, which apply to all “electronic products” that emit “electronic product radiation”—*except for cell phones*.¹⁴³ For perspective, the chart below¹⁴⁴ shows relative human exposures from cell phones and microwave ovens versus other common devices:

¹⁴² 21 U.S.C. §360i *et seq.*

¹⁴³ The Telecommunications Act of 1996 charged the FCC with adopting rules establishing a federal safety standard governing RF emissions from wireless handsets. *See* Pub. L. No. 104-204, §704(b), 110 Stat. 56 (1996).

¹⁴⁴ Electric Power Research Institute Field Measurement Study, *Radio Frequency Exposure Levels for Smart Meters, A Case Study of One Model*, February 2011.

SMART METER RF EMISSIONS VS. OTHER COMMON DEVICES



RF emitted by smart meters is significantly below the levels produced by other common household devices like cell phones and microwaves

- » 250 – 1,250 times less than the exposure from holding a cell phone to your ear.
- » far less than standing next to your microwave.

Source: Electric Power Research Institute (EPRI) Field Measurement Study "Radio Frequency Exposure Levels for Smart Meters: A Case Study of One Model, February 2011.

FDA explains on its website:

A Federal standard limits the amount of microwaves that can leak from an oven throughout its lifetime to 5 milliwatts (mW) of microwave radiation per square centimeter at approximately 2 inches from the oven surface. This limit is far below the level known to harm people. Microwave energy also decreases dramatically as you move away from the source of radiation. A measurement made 20 inches from an oven would be approximately one one-hundredth of the value measured at 2 inches.

* * * *

All ovens must have a label stating that they meet the safety standard. In addition, FDA requires that all ovens have a label explaining precautions for use. . . . Although FDA believes the standard assures that microwave ovens do not present any radiation hazard, the Agency continues to reassess its adequacy as new information becomes available.

Microwave Ovens and Health

. . . Less is known about what happens to people exposed to **low levels of microwaves**. Controlled, long-term studies involving large numbers of people have not been conducted to assess the impact of low-level microwave energy on humans. . . . **The fact that many scientific questions about exposure to low-levels of microwaves are not yet answered require [sic] FDA to continue to enforcement of radiation protection requirements. Consumers should take certain common sense precautions.**¹⁴⁵

FDA, then, takes a precautionary principle approach relative to devices that expose consumers to less RF radiation than portable wireless devices.

In other words, the United States government through the FDA (with unique public health expertise) ensures far more consumer information concerning microwave ovens—that some Americans use 30 seconds a day—than the FCC (with no public health expertise) exerts over cell phones—that substantially all Americans, even children, use regularly (even hours each day) and that have up to 100X the RF power density of microwave ovens. Americans should know that using a cell phone equates to wearing a “halo” with a 2 foot radius of 5 microwaves ovens. If one assumes that both the cell phone and ovens were operating at maximum power, that number would increase to 25 microwave ovens. SAR is directly proportional to RF power density.

VI. THE FCC SHOULD ADOPT A PRECAUTIONARY PRINCIPLE APPROACH.

The FCC should likewise adopt and encourage consumers to practice a “precautionary principle”—i.e., to take reasonable precautions to reduce exposure to

¹⁴⁵ <http://www.fda.gov/Radiation-EmittingProducts/RadiationEmittingProductsandProcedures/HomeBusinessandEntertainment/ucm142616.htm#4>, emphasis added.

EMR from wireless devices.¹⁴⁶ The scientific community has not come to any final conclusions on the potential health effects of wireless device use. Recent studies have been unable to rule out adverse health impact of low-level non-ionizing RF energy, and biological effects were noted in various studies,¹⁴⁷ while other studies did not demonstrate any correlation between cell phone use and adverse health effects.¹⁴⁸ While the existing body of scientific findings has not conclusively linked cell phone radiation to cancer or other diseases in humans, it has been unable to rule out adverse health impact of low-level non-ionizing RF energy neither. Biological effects have been reported in many studies¹⁴⁹ and there is early evidence suggesting possible health risks for people with certain cell phone use patterns.¹⁵⁰ Studies are very limited on the long-term health impact of cell phones and the impact on children. The GAO Report noted that FDA and others maintain the conclusion that “insufficient information was available to conclude mobile phones posed no risk.”¹⁵¹

¹⁴⁶ The precautionary principle states that, if an activity has a suspected risk of causing harm to the public or to the environment, in the absence of scientific consensus that the action or policy is harmful, the burden of proof that it is not harmful falls on those taking the action.

¹⁴⁷ See Section I(D), *supra*.

¹⁴⁸ The GAO Report stated: “Studies we reviewed suggested and experts we interviewed stated that epidemiological research has not demonstrated adverse health effects from RF energy exposure from mobile phone use, but the research is not conclusive because findings from some studies have suggested a possible association with certain types of tumors, including cancerous tumors.” GAO also noted, “Overall study findings did not show an increased risk of brain tumors from mobile phone use, but at the highest level of exposure, findings suggested a possible increased risk of glioma.” GAO Report, at page 8.

¹⁴⁹ See Section I(D), *supra*.

¹⁵⁰ The GAO Report stated: “Studies we reviewed suggested and experts we interviewed stated that epidemiological research has not demonstrated adverse health effects from RF energy exposure from mobile phone use, but the research is not conclusive because findings from some studies have suggested a possible association with certain types of tumors, including cancerous tumors.” GAO also noted, “Overall study findings did not show an increased risk of brain tumors from mobile phone use, but at the highest level of exposure, findings suggested a possible increased risk of glioma.” GAO Report, at page 8.

¹⁵¹ *Id.*, at page 6. In spite of this fact, the FCC states on its website: “Any cell phone at or below these SAR levels (that is, any phone legally sold in the U.S.) is a ‘safe’ phone, as measured by [current testing] standards.” See <http://www.fcc.gov/encyclopedia/specific-absorption-rate-sar-cellular-telephones>.

In his comments to the WHO classification of cell phone radiation as “possibly carcinogenic to humans,” IARC Director Christopher Wild said: “Given the potential consequences for public health of this classification and findings, it is important that additional research be conducted into the long-term, heavy use of mobile phones. Pending the availability of such information, it is important to take pragmatic measures to reduce exposure such as hands-free devices or texting.” Expert health organizations in the U.S., including the American Cancer Society (ACS), The National Cancer Institute (NCI), the FDA, the National Institute of Environmental Health Sciences (NIEHS) and the U.S. Centers for Disease Control and Prevention (CDC), share the same view that although the weight of the current scientific evidence does not establish a definitive link between cell phone use and cancer or other illnesses, more research is needed to understand the long-term effect of cell phone radiation and the effects on children.¹⁵²

One commenter states that employing a precautionary principle or “additional precautionary measures are not needed,” because “the views of the FDA and the WHO [are] that there is no public health risk from mobile telecommunications.”¹⁵³ Once again, this directly contradicts the GAO Report on FDA’s position¹⁵⁴—as well as the 2011 World Health Organization classification of cell phone radiation as “possibly carcinogenic to humans.”¹⁵⁵

The failure to adopt the precautionary principle until science conclusively proves “safety” would be seriously misleading, and against the public interest. Imagine, for

¹⁵² http://www.cdc.gov/nceh/radiation/cell_phones_FAQ.html

¹⁵³ TIA Comments, at page 9.

¹⁵⁴ See GAO Report, at pages 6-7.

¹⁵⁵ See http://www.iarc.fr/en/media-centre/pr/2011/pdfs/pr208_E.pdf.

example, a pharmaceutical company seeking FDA approval for a drug that (its benefits aside) consistently altered patients' brain glucose metabolism to unknown effect. In such a case, were the drug approved, the prudent approach would be to provide prominent consumer warnings rather than notices buried deep in product manuals. As EWG noted, "While the scientific evidence surrounding cell phone use and health effects is not definitive, there is certainly sufficient research to warrant caution."¹⁵⁶ Even *known* carcinogens can take decades to manifest themselves in terms of health effects. As we previously noted,¹⁵⁷ given this uncertainty, the GAO's conclusions that FCC's flawed testing standards likely underestimate radiation absorption by consumers, and the FCC's acknowledged lack of scientific or medical expertise in the subject matter,¹⁵⁸ the FCC should not affirmatively designate cell phones as either "safe" or "unsafe." Instead, the FCC should inform consumers that the science is inconclusive, and provide consumers with as much information as possible as to how to best exercise precautions and minimize exposure. This is precisely the type of circumstance that is appropriate for a precautionary principle approach. Indeed as EWG noted, there is a long latency to determine health impacts, and children in particular have adopted wireless devices only recently in relative terms.¹⁵⁹

¹⁵⁶ EWG Comments, at page 15.

¹⁵⁷ Pong Comments, at pages 34-37.

¹⁵⁸ See NOI Section 6.

¹⁵⁹ EWG notes, "It is important to note that brain tumors have a long latency period of 10 to 15 years. Currently available studies may not be reflective of future trends in disease, particularly in those who began using cell phones as children. It is also notable these studies detected any increase in risk, given the relatively short time periods involved. The long latency period of brain cancer creates yet another layer of uncertainty and yet another reason to implement a more stringent standard." EWG Comments, at pages 7-8, citations omitted.

VII. CONCLUSION

The FCC's equipment authorization process is designed to protect the safety and welfare of consumers. The FCC in its foresight commenced this proceeding in furtherance of these objectives, and to update the record in order to determine whether changes to the FCC's testing regime, would be prudent and advisable for the benefit of consumers. An extensive body of evidence has already been presented in this proceeding that supports such modifications.

Some commenters, however, are effectively asking the FCC to declare that cell phones are safe and, on that basis, to conclude that meaningful, substantive improvements to the FCC's testing regime are unnecessary. The FCC cannot fully serve the public interest by following these requests.

An insidious tone runs through some commenters' filings -- one that considers consumers to be "uninitiated"; incapable of determining what simple words like "possibly" means; undeserving of basic, truthful and helpful information; and unable to use and appreciate such information contextually. But consumers deserve more, and the FCC is empowered to modify the testing guidelines for the benefit of consumers.

Based on extensive evidence presented in this proceeding, the FCC should update its testing guidelines in accordance with the recommendations set forth herein and in our September 3, 2013 comments. Among these:

1. The FCC should modify its testing methodologies, including SAM specifications, more closely to simulate the physiological characteristics of children.

2. The FCC's testing guidelines should be updated to reflect use of devices directly against the body in body-worn configuration, rather than at least 15mm to 25 mm away. Most consumers hold their devices against their bodies and heads. A space of at least 15 mm dramatically impacts SAR, but that is not how consumers typically use devices. Modern habits tend towards much closer proximities, as well as longer exposures.
3. A substantial majority of wireless device users today employ cases that, unquestionably, dramatically impact SAR. The FCC should—consistent with the purposes of Bulletin 65—update its testing guidelines more accurately to reflect predominant consumer behavior. This update should incorporate testing guidelines that include the presence of a case, which would more accurately determine (among other things) the real absorption of radiation by wireless device users. The FCC should also conclude that both requiring that advisory information be more prominent and detailed and supplying accessories to the consumer could be an effective means to ensure adequate awareness and capability to ensure adherence to the SAR standards under all potential usage conditions.
4. The FCC should update its guidelines so that consumers are provided more easily accessible information about how to reduce exposure to RF energy from wireless devices. The FCC should modernize its guidelines better to inform consumers as to how to exercise precautions. These steps could include more prominent advisories, for example, at point of sale, on packaging, and on web sites, that would be easier for consumers to see.
5. The FCC should inform consumers that the science is inconclusive, and provide

consumers with as much information as possible as to how to best exercise precautions and minimize exposure, in essence adopting a “precautionary principle.” The FCC should also refrain from relaxing the safety standard, until such time as the medical and scientific research concludes that use of wireless devices in the manner that consumers including children normally use such devices, is safe. As EWG noted, *“it becomes imperative for the FCC to act. This is not because there is definitive scientific evidence pointing to harm, but rather because the consequences of a miscalculation could be severe, given the ubiquitous use of wireless technology.”*¹⁶⁰

Respectfully submitted,
PONG RESEARCH CORPORATION



Kevin L. Passarello
EVP Business Development and General Counsel
Pong Research Corporation
1602 Village Market Blvd, SE Suite 230
Leesburg, VA 20175

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¹⁶⁰ *Id.*, at page 3.